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VOL. LXII, No. 1617

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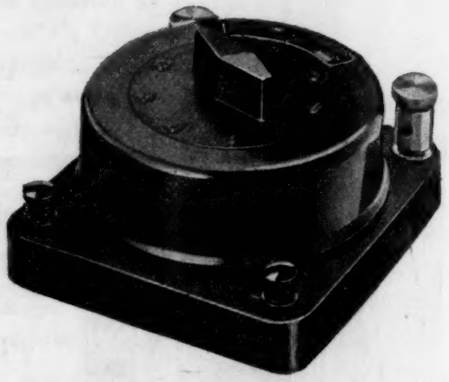

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THE NEED OF MORE WELL-TRAINED PRACTITIONERS OF MEDICINE

DURING the past year SCIENCE has published a number of very interesting and instructive articles on medical education. However, in reading these articles carefully, the thought struck me that not one of them touches upon the most vital question of all, namely, Are the medical schools of this country to-day preparing their students primarily and principally for the services which the citizens of this country need most? Personally, my answer is, No. I fully realize that this is a rather bold statement to make and one with which some very well-qualified educators will take sharp issue, and yet I believe it is absolutely true. My opinion is based on an extensive experience with a large number of recent graduates—graduates from many of the more prominent and some of the less prominent schools of the country. The old adage, "the proof of the pudding is in the eating," is apropos here. The only way to determine definitely whether a medical curriculum, ever so carefully worked out on paper, produces the desired result is to see the recent graduates in action at the bedside. Judged by this standard, I do not believe that the graduate of to-day, with all his fine scientific training, compares favorably as a general rule with the graduate of say twenty-five years ago whose training may have been a little less scientific but much more practical.

The purpose of medical education is to provide for the present and future citizens of the country the best medical care, service and attention that is possible under the circumstances, and judged by this standard, present-day medical education leaves much to be desired.

The country needs a relatively large number of well-trained general practitioners of medicine and a relatively small number of specialists, research workers and sanitarians; and yet the medical colleges are turning out ever-increasing numbers of the latter and relatively few of the former.

Two very interesting and extensive surveys, one by Dr. William A. Pusey, past president of the American Medical Association, and the other by a committee, headed by Dr. Matthias Nichol, Jr., have recently been made, both of which prove conclusively that in many rural sections of this country there is already a shortage of general practitioners of medicine and that there are almost no young men locating in the country. Space prevents printing the evi-

dence collected by them, but Dr. Pusey closes his article with the question: "But why elaborate on the shortage of physicians in rural districts when it is admitted?" and Dr. Nichol's committee reached the following conclusions:

(1) There is a universal tendency for physicians to abandon rural districts in favor of the cities.

(2) The number of those remaining belong in a very large proportion of cases to the older generations.

(3) There is little or no tendency for recent graduates to seek practice outside the large centers of population.

(4) In hundreds of rural districts, medical care is most inadequate or absolutely lacking.

One of the reasons why the medical student of to-day is so poorly prepared for the general practice of medicine when he graduates is because most of the teaching in medical schools is being done by non-medical teachers and specialists. My contention is that fully 90 per cent. of all human ills can be best treated by well-trained general practitioners. If this is true, the students should be prepared for the general practice of medicine instead of for the specialties, sanitary service and research work. Every undergraduate medical student should first of all be given the opportunity to become an efficient general practitioner. Education for the specialties should be left to the properly constituted postgraduate medical schools and hospitals.

At the very outset, let us stress the point that in medicine there is and can be no adequate substitute for practical experience and the larger and more varied this is the better.

Foot troubles are admittedly the cause of much discomfort and loss of efficiency and yet I doubt whether one recent graduate in a hundred knows the fundamental requirements of a well-fitting shoe. If he does not know this, how can he advise a patient in the selection of shoes or how can he relieve the more common and simple foot troubles? He has spent many weary hours learning things of relatively little practical value, but he has not been taught how to properly treat a septic infection of the hand or even a finger, how to efficiently treat a simple cold or to handle the first patient who comes to him with a minor injury, such as a scalp wound, in such an efficient and business-like manner as to inspire confidence.

Research workers are born and then trained; they are not made at random out of all comers. Only an infinitesimal percentage of the general run of medical students will ever discover anything really worth while and these must and will find themselves. What would you think of a farmer who would try to make a race horse of every colt born on the place? I believe you would think of such a one just about what I think of a medical dean or a medical faculty or a system of medical education which trains most of its students for specialists and research workers when the country needs general practitioners. Research work done by most research workers is of very little value and often worse than useless because utterly impractical and because it clutters up an already too voluminous medical literature.

I have been told of a medical dean who asks every prospective professor and instructor, "What research work have you done?" As one of the questions to be asked of a future member of the faculty, there can be no objection, providing the research work is carefully looked over and the dean is convinced that it has been really worth while and not merely rubbish. As a matter of fact, this precaution is rarely taken and the fact that some research work has been done is put down to the credit of the applicant, while often the quality is so poor that it should be put down on the debit side of the ledger. This overvaluing research work, irrespective of its actual worth, is one of the bad things we have taken from German universities. During the years 1896 and 1897, 1904 and 1905, I spent two years in postgraduate work in the universities and hospitals of Austria and Germany and during that period became intimately acquainted with a considerable number of splendid young and middle-aged medical men. Quite a number of them told me that it was practically impossible to get any hospital or university advancement unless they turned out some original work and that the advancement did not depend upon the quality of the original work done but largely upon the time and energy expended. In 1905, I bought a book on "Proctoscopy" in which the investigator reported his findings of the proctoscopic examination of one hundred normal individuals. More than twenty pages of this book are devoted to a study and description of such things as the normal variations of the superficial veins of the lower bowel, as seen with the proctoscope, a study of no more value than if a botanist should pick a hundred normal white oak leaves at random and describe the variations of their contours. The book of 133 pages could have been condensed into a dozen pages and have had everything in it of any practical—yes, even scientific value—and yet that book was at least partly responsible for the author's advancement in the university to which he was attached. But why refer to all this? Simply for the purpose of showing that faculty members thus selected are not qualified to teach students the things they need to know in order to become competent general practitioners.

A more important question to be asked in selecting new members of the faculty of an undergraduate medical school would be: "How much actual personal experience in the general practice of medicine have you had?" Only men of this type can give the medical student who expects to enter the general practice of medicine the training which he most needs and should have, yes, and must have if he is to be efficient and successful. While there can be no objection to an occasional pure scientist on the medical faculty, the number of non-medical teachers has increased to a point where it actually seriously interferes with proper medical education. Who would want to learn how to fly from an instructor who had never flown himself? The really efficient general practitioner needs to know a thousand and one things that make for efficiency, that give comfort and relief to his patient, which the non-medical teachers and specialists can not possibly teach because they do not know these important things themselves.

Overspecialization is a really serious menace to medical progress, and specialization which begins during the undergraduate student's medical education is to be unequivocally condemned. A man who does nothing but remove tonsils may become technically expert in this operation, but unless he has a good background of general medical education and general practical experience he is not even a safe tonsillectomist because he lacks the experience and knowledge requisite to tell him when the patient's general condition is such as to make even so simple an operation as that safe, or what to do and to do promptly should some unforeseen complication arise. A man who does routinely only one operation day after day and has never done anything else is no more a physician in the best sense of that term than a man is a mechanic who does nothing but fasten bolt No. 349 on Ford cars day after day and year after year. The latter type of near mechanic is excusable because a man of very limited intelligence can be secured for such work, but the pseudo physician of the former type is certainly not to be encouraged.

For the past fifty years, Sweden has probably had the highest educational requirements for the degree of doctor of medicine of any country in the world and yet the Swedish people have not had the best medical service, not because their medical men have not been highly educated, but because their number has been inadequate. During the past thirty years, I have personally examined and written the histories of a great many Swedish patients, who came to this country as young men and women, and have come across a goodly number who came from the rural districts of Sweden who had gone through a variety of illnesses and who never had the care and attention of a physician or a dentist. I remember writing the history of one who left Sweden at the age of twenty who had had a number of children's diseases, also typhoid fever followed by osteomyelitis, who during all these had never had a physician—in fact, had never met a physician. Sweden has tried to solve the problem of its medical shortage by licensing Feldschers—men with ordinary common school education and a year's course in minor surgery and bandaging—who are permitted to treat minor surgical cases.

We may be perfectly sure that the rank and file of the American people are going to have medical care when they think they need it, and if the medical colleges of this country do not provide reasonably competent physicians in adequate numbers to fill their needs, the people will prevail upon the legislators of the various states to let down the bars and in that event just how far they will be let down nobody can foretell. During the past session of the Illinois legislature, the profession of the state went through a very strenuous fight to prevent the passage of a law for a special examining board of chiropractors for the licensing of chiropractors and another law to permit all osteopaths to practice all branches of the healing art, irrespective of their training or rather lack of training. If in addition to the underdog and medical monopoly insinuations and the rest of the emotional appeals always introduced at these legislative hearings, the champions of the osteopaths and chiropractors, and there were many such, had been able to demonstrate a serious shortage of regular physicians in any portion of the state, these bills would probably now be laws. All osteopaths would be permitted to practice medicine and surgery in all its branches and the chiropractors would have their own board of examiners to determine who should have a license to practice, and then our splendid medical practice act could no longer protect the public against quacks and charlatans and might as well be repealed, for the protection of the public is about the only legitimate excuse for any medical practice act.

It might facilitate the unraveling of this problem if we dealt with it in the same way that the practicing physician deals with the problems presented to him for solution by each patient who comes to him for advice. First, he tries to make a diagnosis, finds out what is actually the matter with the patient; then determines the etiology, discovers what causes the variations from the normal; then outlines the treatment, advises the patient what to do for the relief

of the condition; then makes a prognosis, determines what the outlook for the future may be.

So far, we have devoted our time to the diagnosis and etiology and have come to the conclusion that there is an impending shortage of well-trained general practitioners of medicine which we believe is very largely the direct result of our present system of medical education:

(1) Our medical students are not being trained for the general practice of medicine.

(2) The medical course is so long and consequently expensive in time and money that from a financial standpoint graduates can ill afford to practice in sparsely settled districts with necessarily limited possibility for financial returns.

(3) It has been shown that country boys are attending medical colleges in relatively smaller numbers than formerly and for the one who does, the long residence in a university center or a large city has usually weaned him from the country, has so citified him that he has aversion for the country, and often has so sissified him that he no longer has the courage to strike out on his own hook away from laboratories, hospitals and consultants. This is a much larger element than most of us realize. The indecision, the feeling of dependency, the lack of courage of the senior interne who is about to be thrust out from the tender and loving care of his Alma Mater and metropolitan hospital is often pitiful to behold.

Recent articles in various medical journals are proof of the fact that medical men all over the country are beginning to think seriously about these problems and that many of them have reached the same conclusions we have. In the June, 1924, number of the *Illinois State Medical Journal,* my presidential address to the seventy-fourth annual meeting of the Illinois State Medical Society on medical education was published. This address was along lines similar to the above. Shortly after its publication a good many commendatory personal letters, some of them from utter strangers, came to my desk, and to show how widespread the feeling of unrest is, I am going to quote from three of these letters. No. 1, from a general practitioner in Michigan who graduated from a Class A school, class of 1919, with two years' interneship in a standardized hospital and three years' experience in general practice:

I received the two pamphlets you sent me a few days ago and I have read them with a great deal of interest. Everything you say in your paper on medical education is true. I can tell you, Doctor, that a young man going out into the general practice of medicine has a good deal to learn which should have been taught him, but was not while in school. The schools try to be ultra-scientific, but they would accomplish more if they prepared their students for the general practice of medicine instead of for the specialties. The professors would have a great deal to learn should they try to do general practice.

No. 2, a rural practitioner from Missouri:

I have just read your article on medical education in the June number of the *Illinois State Medical Journal.* Though I am a total stranger to you, I can't help telling you that you have "hit the nail on the head." I have read your last set of conclusions at the close of the article and I consider it the "handwriting on the wall" for the medics and a "future" for the cultists.

No. 3 from a professor of international reputation:

I have just read with a great deal of pleasure your address on medical education. I agree with what you say *in toto.* Something has gone wrong with medical education. I have been teaching for thirty-five years and have watched the medical students graduate, receive their licenses and practice medicine, and in spite of the wonderful facilities for teaching with which Class A medical schools have been equipped, the graduates of the last ten years are very generally not as good general practitioners as before that period. Of course, there are exceptions. At the present time, they do not receive sufficient instruction from men in general practice who have had clinical experience and know how to teach.

Requirements suggested for the Practice of Medicine

Accredited high school education.

Two years useful, character-building and judgment-forming work if possible under the guidance of an able general practitioner.

Four years intensely practical medical education.

One year interne service.

This would materially shorten the time and greatly reduce the expense of a medical education.

Those who mistake length of time spent in college for efficient training will immediately repeat the slogan, "We can not and must not lower the standards of medical education." No sensible person wants to lower the standard. It is just this that we wish to forestall. If all the useless things with which the student's mind is now burdened were eliminated and only the practical things were taught to a class of serious minded mature students according to the above suggestions, such graduates would actually be much better prepared to practice medicine than are most of the graduates taught by the system now in vogue. First of all, we need a much larger number of teachers who have had clinical experience, and, second, we need a different type of text-books. The greatest medical teacher is not necessarily he who knows the greatest number of scientific facts, but he who can impart to his students the greatest amount of useful, practical information in the least possible time. The most helpful medical text-book is not necessarily the one with the most pages and finest illustrations, but the one with the greatest amount of useful, applicable, easily assimilable in-

formation with the least padding and rubbish. As one writer has well said, "Abolish long lectures on rare conditions, intricate operations and complicated procedures and devote more time to common diseases and minor ailments." The waste of the student's time and energy, two of his most precious assets, on non-essentials is nothing short of scandalous.

In this connection it may be well to remind ourselves that, after all, most of the ills for which patients consult their physicians are minor ones, easily diagnosed and easily relieved if the right remedies are applied.

To illustrate the above and also the general fact that profound learning often has less value in medicine than simple practical knowledge, I wish to cite the following case history: Recently I operated on a young lady for a simple recurrent appendicitis. On making my evening rounds she was in good condition and reasonably comfortable. She was left under the care of the interne and a trained nurse for the night. The next morning her nurse reported that the patient had had little or no sleep because of persistent hiccough. The interne, a recent graduate from one of our most up-to-date scientific universities and medical schools, had not been able to relieve this distressing symptom. He is thoroughly familiar with the theory as to reflex irritation causing singultus, with the nerve tracts along which these impulses are supposed to travel and unduly impressed with the seriousness of this symptom, but not familiar with the simple household remedy that will promptly relieve at least 90 per cent. of all cases of hiccough. If he had been, the patient need not have had a sleepless night. At my direction the patient was given half a teaspoonful of granulated sugar on which ten drops of ordinary vinegar was dropped just as she took it, and that was the last of her discomfort. Let this illustration suffice. If space permitted I could give many illustrations of the above two points.

What medicine needs is not so much more facts as a proper correlation of the facts already known. As things stand to-day the undergraduate student is fairly overwhelmed with facts, the great majority of which are of little practical value. What we need is not more research workers to discover new facts but a few great medical minds who can take the great number of facts already known, separate the non-essential from the essential, arrange and classify them properly so that the latter can be more easily gotten hold of by the student. What we need even more than this is a larger number of medical teachers who can and will teach medical students the essentials of medicine in the shortest possible time without cluttering up their minds with a lot of non-essentials, so that we may have a larger and larger percentage of graduates ready, willing and able to supply the people with efficient medical service for their common ordinary ills, a service which is quite as important and quite as necessary as any that can be rendered to society.

One of the tragedies of life, not infrequently met with, is the case of a young man who has spent eight or ten years preparing for a professional career only to find that he is entirely unsuited for it, either temperamentally or otherwise, or that for some reason he fairly detests it. Some who find themselves thus situated assuage their sorrow and disappointment by marrying rich heiresses and are then usually permanently lost to medicine or any other life of service. The rest flounder along never satisfied and never satisfactory. This could all be very largely avoided if during the two years when they are accumulating practical experience and some of the wherewithal with which to pursue their medical studies, the medical student would spend his leisure time doing systematic reading along medical lines under the guidance of a competent medical practitioner and be permitted to visit patients with such a one, help him some in his work, much after the fashion of the old preceptor system. In this way he would have an opportunity to test his fitness and adaptability for the profession before spending many years and much money, only later often to discover his mistake. The above scheme would give the student a chance to develop the habit of application and industry, to get some practical experience in life with an opportunity to develop judgment and resourcefulness and persistence, things the present-day graduate needs so sorely. It would give him two years of earnings with which to pursue his medical studies and would make it possible for country boys to again enter the medical profession in greater numbers. It would also let the student finish his undergraduate studies by the time he is about twenty-five years of age. If he would now associate himself with an older, busy general practitioner for a couple of years he would be in a position to be a much more useful member of society than is the average graduate of to-day because he would better supply the needs of the times.

THE PROGNOSIS

(1) There is little or no hope for relief from the Council of Medical Education and Hospitals of the American Medical Association or from the faculties of the majority of our medical colleges.

(2) The president of one of the large universities seems to realize the difficulty and has promised relief. We sincerely hope he will not rest until he has solved

this difficult problem and that then other medical colleges will promptly follow his lead. Thinking medical men with large general experience and laymen who realize the need could materially aid matters by disseminating information along these lines.

(3) If a solution is not found and found promptly, we will soon have a shortage of well-trained general practitioners of medicine and in that event quacks and cultists will almost surely receive legislative sanction, and they and other poorly trained persons will take over some of the important functions now performed by the general practitioner. If this happens incalculable injury to the public is bound to result.

The problem of medical education is such an important one because the kind of medical education the undergraduate students of to-day receive will determine very largely the quality of medical service which the citizens of this country will receive from ten to forty years hence.

THREE POSTULATES

Next to the stability of government, honesty of administration and the general intelligence of the people, the welfare of the nation depends more upon the quality of medical service which is rendered to the people than upon any other one thing.

The longevity, health, efficiency and happiness of the people depend more upon the integrity, ability and industry of its medical profession than upon anything else.

The allied professions of medicine, dentistry and pharmacy are to-day giving the American people the best all-around medical service that any nation has ever had in the history of the world, and that by men very largely trained according to the system above proposed.

If the three above postulates are true, and we believe they are, it is the plain duty of those who see the matter as we do to strive incessantly until medical colleges are again rendering the service to the public for which they were primarily organized—namely, to supply an adequate number of well-trained general practitioners of medicine.

EDWARD H. OCHSNER
AUGUSTANA HOSPITAL,
CHICAGO, ILLINOIS

DOCTORATES CONFERRED IN THE SCIENCES BY AMERICAN UNIVERSITIES, 1922–1925[1]

THE Research Information Service of the National Research Council, through the courtesy of the various American universities granting the doctor's degree, has compiled annually since 1919–20 a classified list of the theses of the recipients of this degree in the sciences, with a table showing the comparative statistics for the last ten years. (From 1921–22 through 1922–23, the data for the arts were included, but these were dropped in 1923–24 as too voluminous a compilation of material and as outside the scope of the council's activities.)

The compilations for the first three years were published,[2] but since 1923 the amount of space required has made it impossible to present the data in printed form.

The following tables give the statistical analysis, by university and by subject, of the doctorates conferred during the past ten years. The list of the theses is on file in the Research Information Service and information regarding them will be furnished on request.[3]

The total number of doctorates granted continues to grow slowly, the increase during the years 1923–1925 being much less than during the preceding three years, during which time the universities were recovering from the war period. The totals, however, are much larger than those of the pre-war period. That interest in higher education is greater than ever before is clearly indicated by the following table, which gives the total number of doctorates granted by years during the past twenty-five years. The number in 1925 is almost exactly six times that of 1900.

1900	102	1909	194	1918	29
1901	127	1910	180	1919	18
1902	103	1911	239	1920	32
1903	134	1912	273	1921	33
1904	129	1913	234	1922	44
1905	143	1914	244	1923	57
1906	140	1915	314	1924	59
1907	143	1916	336	1925	62
1908	184	1917	372		

It is interesting to note that Chicago, which has held the lead in sciences for many years, now gives way to Wisconsin. During the past two years eleven universities have granted twenty or more doctorates and eighteen, ten or more.

Chemistry maintains a very considerable lead over any other science. This is undoubtedly due to the many ramifications of the subject, both scientific and industrial. During the past year ten universities

[1] Compiled by Research Information Service, National Research Council.

[2] SCIENCE, 52: 478–83, 514–7 (1920); 55: 271–(1922); *School and Society*, 17: 57–63, 106–9, 132–(1923).

[3] Statistics regarding the doctorates in chemistry and a list of dissertations covering the period 1922–23 to 1924–25 will appear in the *Journal of Chemical Education*.

granted ten or more doctorates in this subject: Columbia, 30; Missouri, 26; Ohio State, 23; Illinois, 18; Massachusetts Institute of Technology, 17; Yale, 16; Chicago, 14; Cornell, 14; Harvard, 13; Johns Hopkins, 10. Fifty or more doctorates were granted in psychology, physics, botany and zoology, twenty or more in bacteriology, mathematics and geology, and ten or more in geography, agriculture and physiology.

TABLE I

DOCTORATES CONFERRED IN THE SCIENCES

	'16	'17	'18	'19	'20	'21	'22	'23	'24	'25
Wisconsin	22	17	16	9	24	15	32	44	41	64
Chicago	53	39	55	28	43	42	61	71	75	59
Columbia	34	37	24	11	25	26	31	58	57	51
Yale	24	25	9	4	23	27	22	34	22	41
Cornell	24	38	30	21	35	33	36	41	60	39
Johns Hopkins	22	24	7	7	21	21	28	58	44	36
Ohio State	2	8	7	3	6	8	13	21	20	33
Illinois	26	24	23	15	22	19	28	33	29	32
California	17	23	16	16	14	22	24	27	20	31
Harvard	16	39	15	14	28	25	21	31	35	25
Minnesota	7	9	10	8	4	16	16	17	23	23
Iowa University	2	3	9	4	5	7	12	12	16	19
Mass. Inst. Tech.	3	4	4	1	8	7	8	11	18	18
Michigan	10	13	8	4	9	7	20	15	25	15
Princeton	19	5	8	3	10	8	12	9	17	15
Stanford	0	4	0	2	4	5	7	8	14	15
Iowa State Col.	—	—	—	—	—	—	—	—	9	12
Pennsylvania	16	7	10	8	5	5	9	8	12	12
Brown	2	3	9	2	2	4	3	3	3	8
Indiana	3	2	4	1	5	1	3	5	5	8
Pittsburgh	0	5	1	2	2	2	7	7	5	8
Cincinnati	2	1	1	1	2	2	5	3	4	7
Nebraska	0	2	1	2	0	4	2	2	5	7
Clark	9	12	4	5	4	6	6	8	3	6
George Wash.	5	8	3	3	9	2	8	13	5	6
New York	0	6	0	2	2	4	3	10	2	5
Virginia	2	1	0	0	1	0	2	1	3	5
Kansas	0	0	0	0	1	1	0	2	2	4
Missouri	3	2	3	0	2	0	4	0	5	4
Catholic	1	2	4	0	1	1	0	1	3	3
Radcliffe	0	1	0	1	1	3	3	3	2	3
Washington	–	0	1	0	0	0	2	0	1	3
Northwestern	3	3	2	0	0	0	7	2	6	2
Bryn Mawr	3	2	1	1	1	2	7	0	1	1
Colorado	0	0	0	0	0	0	1	1	0	1
Wash. Univ., St. Louis	0	2	2	1	3	3	2	8	2	0
North Carolina	2	0	1	1	0	2	1	2	1	0
Boston	0	1	0	0	0	0	0	1	0	0
Mass. Agr. Col.	3	0	0	0	0	1	2	1	1	0
Texas	0	0	0	0	0	0	0	1	0	0
Syracuse	0	0	4	0	2	1	1	0	0	0
Notre Dame	—	—	—	—	—	—	—	—	1	0
Totals	336	372	293	180	325	334	450	572	597	621

TABLE II

DOCTORATES CONFERRED ACCORDING TO SUBJECTS

	'16	'17	'18	'19	'20	'21	'22	'23	'24	'25
Chemistry	115	108	75	54	97	133	155	182	246	244
Zoology	34	30	33	24	38	37	39	45	42	71
Botany	37	37	39	23	48	29	37	64	56	65
Physics	35	32	17	18	19	28	56	54	51	56
Psychology	19	32	30	21	38	26	32	46	51	51
Geology	17	24	14	5	17	11	22	34	41	25
Mathematics	34	30	23	7	19	16	20	28	30	22
Bacteriology	5	11	11	6	7	19	15	32	12	20
Physiology	14	18	11	1	13	8	18	20	17	17
Agriculture	6	19	18	12	8	3	9	10	11	13
Geography	3	3	1	0	3	5	3	7	3	13
Pathology	2	6	8	6	3	1	27	21	12	5
Anatomy	1	3	5	0	3	4	5	10	5	4
Mineralogy	0	0	0	0	0	0	0	1	1	4
Astronomy	6	5	0	1	4	5	4	6	7	3
Metallurgy	1	0	1	1	0	2	1	2	2	3
Anthropology	1	4	2	0	2	4	0	3	3	2
Engineering	3	5	4	1	6	3	4	5	5	2
Paleontology	3	4	0	0	0	0	1	2	2	1
Meteorology	0	1	1	0	0	0	2	0	0	0
Totals	336	372	293	180	325	334	450	572	597	621

CALLIE HULL,
CLARENCE J. WEST

THE PROPOSED NATIONAL ARBORETUM AT WASHINGTON

IN response to the request of SCIENCE for an article on the National Arboretum which is proposed to be established in the District of Columbia, I present the following condensed explanation of the project:

SUMMARY

Nature. The proposed national arboretum at Washington would contain a permanent living collection of trees and other outdoor plants for purposes of scientific research and education. It would include the trees, shrubs, and perennials used in forestry and horticulture, and the wild relatives of these plants. It would be a bureau of standards for horticulture. It would contain a water garden and a wildrice preserve, and it would serve incidentally as a bird sanctuary.

Economic value. The arboretum would make the work of the Department of Agriculture more valuable to the country in many ways, but especially through plant breeding. The development of faster-growing timber trees, improved fruits, and disease-resistant plants generally, through the facilities afforded by the arboretum, would increase profoundly the agricultural wealth and welfare of the United States.

Location. The Mount Hamilton and Hickey Hill tracts in the District of Columbia, together with the Anacostia River flats above Benning Bridge, constitute an admir-

able site for the arboretum, convenient in location and with a great variety of soils.

Cost. About 400 acres of the proposed site is already owned by the government. It consists of marsh land, about to be drained by army engineers. The Mount Hamilton and Hickey Hill area, 408 acres, privately owned, was reported by the assessor in January, 1925, to be valued at $343,048, distributed among thirty owners.

Maintenance. If the purchase of the Mount Hamilton and Hickey Hill tracts in the fiscal year 1927 is authorized, it is estimated that the cost of maintenance of the arboretum for the first three years would be as follows:

1927. Nothing
1928. $25,000
1929. $50,000

To the summary given in the preceding paragraphs is added the following more explicit statement regarding the national arboretum:

1. The examination and mapping of the proposed arboretum site by a soil expert in 1917, by direction of Secretary of Agriculture David F. Houston, showed that the soils of this area are very diverse, over thirty different types being represented on the map accompanying the report. The area was described by Secretary Houston as "admirable in location, topography, present plant cover and in capabilities of future development."

2. The arboretum would contain a comprehensive collection of trees and other outdoor plants for purposes of scientific research and education.

3. It would serve as an introduction garden for the permanent preservation of authentic living specimens of the thousands of plants introduced by the Department of Agriculture from foreign countries.

4. It would contain all the wild relatives of cultivated plants which will grow out of doors in this climate, and would be an invaluable source of material for the breeding of more valuable varieties.

5. It would furnish such a knowledge of the breeding of forest trees as would make it possible, when the country reaches the point of setting out its forests, to use improved varieties which may grow twice as fast as those we now use.

6. It would furnish material for the breeding of disease-resistant varieties of cultivated plants to replace many of the present varieties which are of high quality but so subject to disease that the cost of their treatment is a heavy burden on American agriculture.

7. As a living collection of the species and varieties of trees and other cultivated plants it would constitute a bureau of standards for horticulture.

8. The plants in an agricultural experiment station may be likened to the books which one keeps in his office for continual every-day use, while a national arboretum may be regarded as a great library of living trees and plants from which can be obtained at once whatever is needed for some special investigation or experiment.

9. The national arboretum at Washington would constitute an out-door recreation area of 800 acres which would also be an instrument of widespread public education in botanical science, horticulture, agriculture and landscape gardening.

10. The city of Washington now has about two hundred professional botanists, most of them engaged in the advancement of American agriculture through their connection with the United States Department of Agriculture. The effectiveness of the work of these men and women will be enormously increased through the facilities afforded by a national arboretum.

11. The plan of the arboretum includes the preservation of a large tract of the original wildrice growth of the Anacostia River marshes as a feeding ground and refuge for bobolinks, blackbirds and other migratory birds which have frequented these marshes in hundreds of thousands.

12. The arboretum would constitute a permanent bird sanctuary.

13. The marsh area of the arboretum is well adapted to the development of a water garden, the beauty of which is well illustrated by the Shaw waterlily gardens now occupying a portion of the marshes.

14. Under authority similar to that given in the arboretum bill presented in the last congress, it will be possible to purchase the Mount Hamilton and Hickey Hill tract of 408 acres of forest and intervening farm land before the advance of the city turns this area to other uses. Whether the arboretum be developed rapidly or slowly, the area ought to be purchased at once.

15. The assessor's present valuation of the Mount Hamilton and Hickey Hill tract is $343,048, distributed among thirty owners. In 1920, when the purchase of the tract was under consideration for another purpose, the assessor's valuation was $254,520.

16. For maintenance of the arboretum it is unlikely that any funds additional to the purchase money would be required the first year. It is estimated that in the second year $25,000 would be needed, for accurate topographic, biological and other surveys and plans and preliminary soil treatment, and in the third year $50,000, for the expenses of an efficient operation and maintenance organization. These estimates do not include engineering development and permanent highway construction, which must be determined through conference with the board of army engineers now engaged in the drainage of the Anacostia River marshes, and with the Commissioners of the District of Columbia.

17. The proposed arboretum site is less than two

miles from the capitol building and three miles from the Department of Agriculture.

18. The location of the arboretum at a distance of several miles from the city has been proposed. In such a location the cost of administration would be greater, the work of research and discovery less effective, and the arboretum would be less useful for public education and recreation.

On December 7, 1925, Representative Robert Luce, of Massachusetts, introduced in the House of Representatives the following bill (H. R. 3890), which was referred to the Committee on Agriculture. An identical bill (S. 1640) was introduced in the Senate by Senator George Wharton Pepper, of Pennsylvania, and referred to the Committee on Agriculture and Forestry.

A BILL

AUTHORIZING THE SECRETARY OF AGRICULTURE TO ESTABLISH A NATIONAL ARBORETUM, AND FOR OTHER PURPOSES

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of Agriculture is authorized and directed to establish and maintain a national arboretum for purposes of research and education concerning tree and plant life. For the purposes of this Act, (1) the President is authorized to transfer to the jurisdiction of the Secretary of Agriculture by Executive order any land which now belongs to the United States within or adjacent to the District of Columbia located along the Anacostia River north of Benning Bridge, and (2) the Secretary of Agriculture is authorized in his discretion to acquire, within the limits of the appropriation authorized by this Act, by private purchase, condemnation proceedings, or gift, land so located.

Sec. 2. There is hereby authorized to be appropriated a sum not to exceed $300,000, to be expended under the direction of the Secretary of Agriculture for the acquisition of land as specified in section 1. No payment shall be made by the United States for any such land until the title thereto is satisfactory to the Attorney General and is vested in the United States.

Sec. 3. In order to stimulate research and discovery, the national arboretum established by the Secretary of Agriculture in accordance with the provisions of this Act shall be under competent scientific direction. The arboretum shall be administered by the Secretary of Agriculture separately from the agricultural, horticultural, and forestry stations of the Department of Agriculture, but it shall be so correlated with them as to bring about the most effective utilization of its facilities and discoveries.

Sec. 4. The Secretary of Agriculture is authorized to recognize and consult an advisory council in relation to the national arboretum to be established under this Act, to include representatives of the following organizations: National Academy of Sciences, National Research Council, Smithsonian Institution, Carnegie Institution of Washington, Garden Club of America, Wild Flower Preservation Society, Botanical Society of America, American Society of Landscape Architects, American Association of Nurserymen, National Association of Audubon Societies, American Forestry Association, Society of American Foresters, American Pharmaceutical Association, and American Association for the Advancement of Science.

FREDERICK V. COVILLE

SCIENTIFIC EVENTS

THE PAN-PACIFIC RESEARCH INSTITUTION

THE Pan-Pacific Union, an international organization having its center at Honolulu, has served an excellent purpose in two main directions. The first, in its mission of good-will to the various peoples whose lands border on the Pacific, and second, in the several international conferences, educational, journalistic, economic and scientific, called to meet under its auspices and under the general direction of its director, Alexander Hume Ford.

Last year a new departure was planned, that of an international research station, after the fashion of the one at Naples and the one at Woods Hole. With certain disadvantages of remoteness from centers of population, it has the advantage of access to a marine fauna of unparalleled richness. In addition to this, it affords a remarkable opportunity for the study of tropical fruits, of insect pests and the parasites which destroy them, of a tropical flora and of volcanic geology.

For the present summer, Dr. David Starr Jordan, as honorary president of the institution, has assisted Mr. Ford in its permanent organization. Its board of trustees is made up of leading men interested in the project from the various countries included in its scope. Its actual government is vested in a local council of scientific men engaged in actual research, in the employment as experts by the United States government, by the Territory of Hawaii, the Queen's Hospital or by some one of the great associations interested in sugar, pineapples, coffee or other industries. The headquarters of the institution are in a commodious residence in the Manoa valley, dedicated to this purpose by its owners. Here the council meets weekly at dinner, being followed by a scientific lecture, to which the public is invited. The chief purpose of the institution is the promotion of research in any field, in which local conditions are favorable. For the time being, only a small number of workers can be accommodated free of charge at the headquarters and no funds are yet available for special assistance. A bulletin is published monthly, but until a permanent endowment for publication is secured no records of new species of animal or plant will be

received for printing. The facilities for advanced work in the Bishop Museum, the University of Hawaii and the Queen's Hospital will in general be at the service of any worker.

The first scientific publication of the institution is "A Check-List of the Fishes of Hawaii," by Dr. David Starr Jordan and Dr. Barton Warren Evermann. This list includes 583 species, including pelagic and bathybial forms.

The present council consists of the following persons, each of these being at the same time chairman of some special research committee:

Chairman, Dr. Nils P. Larsen, medical director of the Queen's Hospital.

Vice-chairman, Dr. Frederick G. Krauss, professor of agronomy, University of Hawaii.

Recording Secretary, Wm. Weinrich, chemist.

Honorary President for 1925–26, David Starr Jordan, chancellor emeritus of Stanford University.

E. A. Beals, meteorologist, U. S. Weather Bureau.

Colonel J. M. Brown, judge advocate, U. S. A.

Dr. C. B. Cooper, ex-president of the Board of Health.

L. A. Henke, professor of animal husbandry, University of Hawaii.

Dr. James F. Illingsworth, research associate in entomology, Bishop Museum.

H. Atherton Lee, pathologist, Sugar Planters' Association.

Kilmer O. Moe, agriculturist, Kamehameha Schools.

Willis T. Pope, horticulturist, U. S. Experiment Station.

PLANS FOR INCREASING THE FUNDS OF THE NATIONAL ACADEMY OF SCIENCES

The National Academy of Sciences has appealed to a body of prominent public men to join leading scientists of the country in an endeavor to secure larger resources for research in pure science.

It is hoped that an annual income of $2,000,000 can be secured to establish national research professorships and in other ways to cooperate with universities and other institutions.

The academy has created for these funds a special board of trustees, the membership of which consists of the following:

Herbert Hoover, *chairman;* Dr. Albert A. Michelson, president of the National Academy of Sciences; Gano Dunn, chairman of the National Research Council; Dr. Vernon Kellogg, permanent secretary of the National Research Council; John W. Davis; Colonel Edward M. House; Cameron Forbes; Felix Warburg; Henry S. Pritchett; Dr. Robert A. Millikan, foreign secretary of the National Academy of Sciences; Dr. John C. Merriam, president of the Carnegie Institution of Washington; Owen D. Young and Henry M. Robinson; Elihu Root; Charles E. Hughes; W. H. Mellon; Dr. Simon Flexner, director of the laboratories of the Rockefeller Institute for Medical Research; Dr. John J. Carty, vice-president of the American Telephone and Telegraph Company; Dr. William H. Welch, director of the School of Hygiene and Public Health of the Johns Hopkins University; Dr. James H. Breasted, director of the Oriental Institute of the University of Chicago; Professor L. R. Jones, of the University of Wisconsin; Professor A. B. Lamb, of Harvard University; Professor Oswald Veblen, of Princeton University; Dr. Thomas H. Morgan, of Columbia University, and Dr. George E. Hale of the Mount Wilson Observatory.

The chairman of the board, Mr. Hoover, made the following statement:

While we have in recent years developed our industrial research upon a scale hitherto unparalleled in history we have by no means kept pace in the development of research in pure science. The sudden growth of industrial research laboratories has in itself endangered pure science research by drafting the personnel of pure science into their ranks. Thus, applied science itself will dry up unless we maintain the sources of pure science. We must add to knowledge, both for the intellectual and spiritual satisfaction that comes from widening the range of human understanding, and for the direct practical utilization of these fundamental discoveries.

THE STERLING RESEARCH FELLOWSHIPS AT YALE UNIVERSITY

With the assistance of a fund of $1,000,000 provided by the trustees of the estate of the late John W. Sterling, of New York City, Yale University will begin next fall an intensive effort to stimulate advanced research and graduate study in all fields of knowledge according to an announcement outlining the plans for the allocation of the million dollar fund.

The Sterling fellowships will be divided into two classes: Research or senior fellowships and junior fellowships. Candidates for senior fellowships, who will be expected to undertake advanced research, must have already received the degree of doctor of philosophy or its quivalent. It is anticipated that the maximum annual amount awarded to such fellows will be perhaps $2,500 or $3,000.

Junior fellowships will be open to students who have accomplished a substantial part of the work for the Ph.D. degree. It is expected that they will receive between $1,000 and $1,500.

These fellowships will be open equally to graduates of Yale University and other approved colleges and universities in the United States and foreign countries. They are open to graduate students or teachers on leave of absence who desire to carry on studies or investigations under the direction of the graduate faculty of Yale University or in affiliation with it. Since these fellows are expected to devote their entire time to research, they will not be permitted to engage in teaching during their appointments.

THE SCIENCE EXHIBIT AT THE CARNEGIE INSTITUTION

THE annual exhibition of the current researches of the Carnegie Institution was opened in Washington on December 11, on the occasion of the annual reception of the president and board of directors. The exhibits were opened to the public on the following three days.

By special arrangement with the Naval Research Laboratory and the Bureau of Standards, the radio stations of those places alternated in sending special messages or signals to a receiving station that had been set up in the exhibition room. By means of special apparatus, the radio waves were made visible and the change which takes place when messages were being received could be observed.

This exhibit is part of the demonstration of the work being done by the department of terrestrial magnetism. It is identified with a study of the highly electrified stratum of atmosphere supposed to exist above the surface of the earth.

Of no less interest to the layman were a number of exhibits from the department of embryology, by means of which the visitor saw various stages of the development of living chick embryos. These embryos ranged in age from the first beat of the heart up to a stage that would compare somewhat with the third month of human prenatal development. By means of powerful microscopes, visitors were permitted to watch the development progress.

Another section of the exhibit showed living cultures of tumor cells growing in a drop of plasma. Here, too, strong glasses made it possible for the visitor to watch the cells multiplying for their destructive careers. And close by was a demonstration of epithelioid cells and giant cells waging their war on tuberculosis cultures. All these subjects are under investigation at the department of embryology.

Other exhibits included researches in astronomy, archeology, Roman building construction, physics, seismology, plant physiology, ecology, nutrition, genetics, marine biology, history and diatom research. Instructors were in charge of all the exhibits to explain the meaning of each example to the visitors.

MINUTE ON THE DEATH OF LOUIS R. SULLIVAN

THE following minute was passed by the Galton Society at a meeting held in the American Museum of Natural History on October 28:

WHEREAS, The late Dr. Louis R. Sullivan was one of the most active members of the Galton Society, of which he was elected a fellow in 1918, soon after the foundation of the society;

WHEREAS, He presented at its meetings the chief results of his important investigations upon the racial history of the Polynesians, the racial composition of the present mixed population of the Hawaiian Islands, the relationship of the Punin Ecuador skull and other topics of exceptional anthropological interests;

WHEREAS, At the time of his death Dr. Sullivan's most ably conducted and comprehensive studies were leading him to still more important conclusions concerning the classification and evolutionary history of the races of mankind;

WHEREAS, The American Museum of Natural History has undertaken so far as possible not only to complete and publish the investigations upon which he labored almost to the day of his death, but also to carry on further researches along the lines planned by him;

WHEREAS, His good humor, his breadth and sympathy, as well as his keen and sensitive intelligence and other attractive personal qualities had inspired the devotion of his many colleagues and friends; therefore, be it

Resolved, That the members of the Galton Society hereby record their appreciation of the fruitful life and works of their late friend and colleague and their gratification that the investigations conducted by him are to be carried on along the lines he had planned; and be it further

Resolved, That a copy of this resolution be forwarded to the widow and family of our late friend and colleague in token of our deep sympathy for their loss.

CHAS. B. DAVENPORT,
Chairman
WILLIAM K. GREGORY,
Secretary

SCIENTIFIC NOTES AND NEWS

SCIENCE has printed extended preliminary announcements of the meeting of the American Association for the Advancement of Science and the national affiliated scientific societies to be held at Kansas City, from Monday, December 28, to Saturday, January 2. They promise a meeting of importance and wide interest. Every member who can do so should attend the meeting in his own interest and to do his part for the advancement and diffusion of science.

DR. JAMES F. NORRIS, professor of chemistry at the Massachusetts Institute of Technology, has been re-elected president of the American Chemical Society.

CUMMINGS C. CHESNEY, manager and chief engineer of the Pittsfield works of the General Electric Co., has been nominated for president of the American Institute of Electrical Engineers.

DR. EDWIN G. CONKLIN, professor of zoology at Princeton University, has been granted a year's leave of absence to study research conditions in Japan, under the auspices of the Rockefeller Foundation.

Dr. and Mrs. Conklin expect to sail from San Francisco on December 26.

DR. HARLOW SHAPLEY, Paine professor of practical astronomy at Harvard University and director of the Harvard Observatory, has been appointed visiting lecturer to the universities of Belgium by the C. R. B. Educational Foundation, established by the Commission for Relief in Belgium, and will visit the four Belgian universities next April and May.

DR. JOHN J. ABEL, professor of pharmacology in the Johns Hopkins University, has recently been notified that he has been elected a member of the Kaiserlich Deutsche Akademie der Naturforscher zu Halle, the oldest scientific society in Germany, having been founded in 1652.

THE honorary degree of doctor of laws has been conferred by the Sorbonne, Paris, upon Sir Ernest Rutherford, of the University of Cambridge; Dr. Hideyo Noguchi, of the Rockefeller Institute; Professor I. P. Pavlov, of Leningrad, and Professor M. Charles de la Vallee Poussin, of the University of Louvain.

DR. RICHARD WILLSTÄTTER, formerly professor of chemistry at Munich, has received an honorary degree from the University of Zürich.

AT the annual general meeting of the Junior Institution of Engineers held on November 13 A. J. Simpson was elected chairman.

FRANK D. PAINE, professor of electrical engineering at Iowa State College, has been appointed assistant director of the committee on the relation of electricity to agriculture, with headquarters at Ames. A leave of absence for the period of a year has been granted to him by the Iowa State College.

DR. HENRY CHANDLER COWLES, of the University of Chicago, has been appointed a member of the Illinois State Board of Natural Resources and Conservation to succeed Dr. John M. Coulter, who is now at the Boyce Thompson Institute in Yonkers, N. Y.

AT Western Reserve University, Dr. John M. Ingersoll, professor of otolaryngology, and Dr. William H. Humiston, clinical professor of gynecology, have resigned. They have both been made professor emeritus in the university.

PROFESSOR J. AMBROSE FLEMING, the distinguished English electrical engineer, celebrated his seventy-sixth birthday on November 29.

DR. WILLIAM E. GYE has been awarded the annual fellowship established by London University for the graduate of that institution who has done the most toward the advancement of medical science in the past five years. The fellowship carries a stipend of abou $1,500.

DR. F. F. NORD recently arrived from Germany t take a position in the section of biochemistry of th Mayo Foundation, Rochester, Minnesota.

DR. JOHN ALDEN MASON has resigned his positio at the American Museum of Natural History as as sistant curator of Mexican archeology to take a posi tion with the University Museum of Philadelphi where he becomes curator of the American section.

HARRY L. SHAPIRO, of Harvard University, has bee appointed assistant curator of physical anthropolog at the American Museum of Natural History.

DR. T. U. H. ELLINGER, of Chicago, has been ap pointed director of a department of live stock ec nomics, recently established by the International Liv Stock Exposition Association.

R. E. KARPER, superintendent of the Lubbock sub station of the Texas agricultural experiment statio system, has been made assistant director and agrono mist at the main station, College Station, Texas.

DR. FRANCIS CARTER WOOD, director of the Crocke Institute of Cancer Research, at Columbia University has gone to England to make an investigation o Dr. W. Blair Bell's method of lead treatment for th cure of cancer.

DR. JAMES P. CHAPIN, of the American Museu of Natural History, will head a museum expeditio to East Central Africa to study the birds and faun and to make collections for exhibition purposes. Th members of the expedition will leave New York earl in January and expect to start inland from th African coast about March 1.

DR. H. F. KERN, of the U. S. Bureau of Anima Industry, left on December 10, on a two years' fur lough from the bureau, to accept a position as veter inarian to the San Salvador government.

DR. HENRIK LUNDEGARDH, director of the Ecological Station at Torekov, Sweden, is making a short sta at the New Jersey State Agricultural Experimen Station.

AMONG foreign scientific men who have visited th United States within the past few weeks are Dr Hugo Weigold, director of the Provinzial Museum a Hanover, Germany; Dr. H. Boschma, of the Univer sity of Leyden; Dr. Stepan Soudek, assistant in th zoological institute of the College of Agriculture an Forestry at Brno, Czechoslovakia, and Dr. Brook Nicholls, of Melbourne University.

DR. FREDERICK O. BOWER, until lately Regius pro

fessor of botany in the University of Glasgow, concluded his lecture tour of the United States and Canada, with a series of three lectures at the Johns Hopkins University, the first week in December.

DR. NORBERT WIENER, assistant professor of mathematics at the Massachusetts Institute of Technology, has been invited to deliver a course of lectures at the University of Göttingen, Germany.

DR. J. B. COLLIP, professor of biochemistry in the University of Alberta, will deliver the fourth Harvey Society lecture at the New York Academy of Medicine on Saturday evening, January 2, at eight thirty. His subject will be "The Internal Secretion of the Parathyroid Glands."

DR. R. W. WOOD, professor of experimental physics at the Johns Hopkins University, lectured before the Franklin Institute, Philadelphia, on December 16, on the subject of "The Optical Excitation of Metallic Spectra."

DR. SIMON FLEXNER, director of the Rockefeller Institute for Medical Research, delivered the third Weir Mitchell oration on December 9 at the College of Physicians, of Philadelphia, on "The Advancement of Epidemiology through Experiment."

DR. GEORGE P. MERRILL, curator of geology and mineralogy at the United States National Museum, delivered a series of four lectures on "Meteorites" at Columbia University from November 17 to 20.

DR. ERWIN F. SMITH, plant pathologist for the United States Department of Agriculture, gave an address before a meeting of the Washington Academy of Sciences on December 17 on "Recent Views as to the Cause of Cancer."

AT a luncheon on December 5, at the University of Chicago, given by President Max Mason, Dr. William H. Mayo, Rochester, Minn., gave an address on "Chemistry in Medicine"; Dr. Arthur D. Little, Cambridge, formerly president of the American Chemical Society, an address on "Chemistry in Industry," and Dr. Julius Stieglitz, head of the department of chemistry at the University of Chicago, spoke on "Chemistry in the University."

THE joint annual meeting of the Newburgh and Poughkeepsie Medical Societies was held at Newburgh, N. Y., on November 17. Dr. Smith Ely Jelliffe, of New York, gave an address on psychoanalysis and organic disease.

DR. E. F. NORTHRUP, vice-president of the Ajax Electrothermic Corporation, lectured before the Franklin Institute on the subject of "Ironless Inductive Heating" on December 3.

DR. FRITZ LENZ, professor of race hygiene at the University of Munich, lectured during September at the Universities of Uppsala and Lund, Sweden.

PROFESSOR J. C. G. LEDINGHAM gave on December 9 the Harben lectures of the Royal Institute of Public Health, England, on the subject of the current problems in bacteriology and immunology and their bearing on public health effort.

THE ward at the Glasgow Infirmary, Scotland, in which Joseph Lister did his early work in antisepsis and which was dismantled a year ago, has been purchased by the firm of Burroughs Wellcome and re-erected in London.

A BUST of Heinrich Hertz, discoverer of the high frequency waves bearing his name, has been presented by his daughter, Dr. Mathilde Hertz, to the Karlsruhe High School to commemorate his seventeen years of teaching in the school. The occasion was the celebration of the centennial of his birth.

PROFESSOR H. A. GOSSARD, president of the American Association of Economic Entomologists and chief of the Department of Entomology at the Ohio Agricultural Experiment Station, died by suicide on December 18. Professor Gossard was fifty-seven years of age and had been in ill health.

DR. NATHAN E. BRILL, professor of clinical medicine at the Columbia University College of Physicians and Surgeons, died on December 14, at the age of sixty-five years.

DR. JOHN LEWIS HILDRETH, emeritus professor of clinical medicine and formerly dean at Tufts College Medical School, Boston, died on November 27, at the age of eighty-seven years.

SIR RICHARD DOUGLAS POWELL, formerly president of the Royal College of Physicians, died on December 15, aged eighty-three years.

DR. LAMBINET, chief of the bacteriologic service at the University of Liége, and a pioneer in study of hookworm, has died.

THE new Peabody Museum of Natural History at Yale University will be opened on December 29. Speakers at the dedication ceremony will be Dr. James Rowland Angell, president of the university; Dr. Charles Schuchert, professor of paleontology; Dr. Richard Swann Lull, director of the museum, and Dr. Henry Fairfield Osborn, president of the American Museum of Natural History.

THE forty-fourth course of popular lectures will be given at the Stanford University Medical School on alternate Fridays at 8 p. m., as follows: January 8, "Dietary Peculiarities of Children," Dr. H. K.

Faber; January 22,, "Skin Disturbances from Foods and Drugs," Dr. H. E. Alderson; February 5, "Ductless Glands and Obesity," Dr. Hans Lisser; February 19, "Gastrointestinal Disturbances and Nutrition," Dr. P. K. Brown; March 5, "Fatigue and Rest," Professor E. G. Martin; March 19, "On the Prevention of Disease," Dr. G. E. Ebright.

THE Sigma Xi Alumni Association of the University of Pittsburgh held a meeting on December 14 at which the following program was presented by members of the staff of the Medical School: "The Alleged Veratrine Action of Epinephrine on Skeletal Muscle," Dr. T. K. Kruse; "The Rôle of the Endothelial Leukocyte in Tuberculous Infections," Dr. S. R. Haythorn; "Principles underlying the Mechanism of the Heart Beat," Dr. H. G. Schleiter; "Regeneration in the Amphibian Spinal Cord," Dr. D. Hooker.

THE status of cancer research in the great European laboratories and the question of what research is doing to-day to aid diagnosis and treatment of the disease was discussed by Dr. George A. Soper, managing director of the American Society for the Control of Cancer, and Dr. William A. Woglum, of the Crocker Institute for Cancer Research at Columbia University, at a joint meeting of the Baltimore City Medical Society and the Maryland Cancer Committee, arranged for the purpose of "giving active workers in the field of cancer an opportunity to hear what is being done on the research side of the problem."

ACCORDING to *Industrial and Engineering Chemistry*, the National Live Stock and Meat Board has granted the National Research Council $6,000 for a period of two years for research concerning the nutritive value of meat. The National Research Council special committee appointed to handle this money has granted two fellowships. In addition to this fund the board has granted a fund of $250 to E. B. Forbes, of State College, Pennsylvania, for work on the iron content of meat. The Institute of American Meat Packers has made a grant of $3,500 to Yale University for research under the direction of Professor L. B. Mendel on the influence of food on the quality of fat produced in the animal body. This is the third year of this grant.

A REPORT on the estate of the late Ohio C. Barber, of Ohio, shows, according to press dispatches, that more than $5,000,000 of the estate will be used to establish the Ohio C. Barber Agricultural and Industrial School, to be conducted in connection with Western Reserve University.

THE Green Bay Museum, Green Bay, Wis., of which Arthur C. Neville is director, has received a gift of $50,000 for the erection of a much needed new museum building. The donors are Mr. and Mrs. George Grant Mason, of New York City. The gift is conditioned upon agreement by the city to maintain the building and to name it The Neville Public Museum.

THE geological department of Vanderbilt University has recently bought the Lyon collection in geology. This collection was originally gathered by Sydney S. Lyon and later was greatly enlarged by his son, Victor W. Lyon. It consists of some thousands of fossils mainly from classical paleozoic localities in Kentucky and Indiana, among which there are a number of types. In addition there are some minerals, several hundred pamphlets and between 3,000 and 4,000 books on geology and paleontology. It is probably one of the last of the old-time private collections.

M. TATSUKE has donated 500,000 yen for the erection of a hospital and medical institute building in Osaka at the Kyoto Imperial University. The medical institute probably will be named the Tatsuki Institute.

THE Academy of Medicine of Paris has been left a legacy of 50,000 francs by Madame Alphonsine-Matilde Maire for founding a biennial prize, to be known as the "Prix Docteur Jules Brault," for the best work on exotic pathology or dermatology.

THE University of Pennsylvania has received a gift from Mr. and Mrs. Frederick S. Duncan, of Englewood, N. J., of a family portrait of Robert Adrain, his private library and the manuscripts of his original researches. Dr. Adrain was made professor of mathematics and natural philosophy in Queen's College, now Rutgers. In 1813 he was selected for a similar professorship in Columbia University. In 1826 he became professor of mathematics and vice provost of the University of Pennsylvania.

WORK has been started in the suburb of Annenhof near Moscow on the construction of a series of buildings intended to accommodate the Russian Experimental Electrotechnical Institute with all its workshops and laboratories. Each one of the buildings will be especially constructed to suit its requirements. Thus, the machinery and appliance laboratory will be equipped with a special hall for the testing of the different systems of illumination, etc. The construction costs are tentatively estimated at five million roubles. About two million five hundred roubles will be required for the equipment of the laboratories.

THREE fellowships for research in fertilizer usage have been placed by the National Fertilizer Association in the South. One is assigned to Mississippi Agricultural and Mechanical College, on the study of the value of potash in mixed fertilizers and the effect of potash on rust and wilt of cotton. The other

two fellowships are to be at the Georgia State College of Agriculture and Clemson College, South Carolina, to study methods of applying fertilizers as to time, placement and rate of applications on typical Piedmont and Coastal Plain Soils.

A STUDY of the agriculture of the Connecticut Valley, with particular reference to solving the problems of the tobacco growing industry, is being undertaken by the Connecticut Agricultural College, with the endorsement of the Connecticut Valley Tobacco Growers Association. As outlined by Professor I. G. Davis, head of the economics department, under whose direction the survey will be conducted, it will consist of four phases. When completed, it is hoped, it will lay the foundation for a continuously sound agricultural program for the Connecticut Valley.

THE first agricultural college in Burma was recently opened at Mandalay, according to *The Experiment Station Record*. A farm of 600 acres and facilities for a four-year course for 84 students have been provided. Special attention is to be given to the selection of better varieties of rice, beans, cotton and sugar cane, the study of plant diseases, silk culture and the building up of a pedigreed herd of pure Burma cattle.

UNIVERSITY AND EDUCATIONAL NOTES

THE residuary estate of the late Lewis B. Woodruff, ornithologist and lawyer of New York, has been left to Yale University "to further the interests of its museum." The amount has not been made public. In addition a permanent fund of $10,000 is provided for the New York Entomological Society. The will suggests that the income be devoted primarily to the publication of technically illustrated monographs of groups within the field of the society's authorized activities. All his scientific collections and material on natural history are given to the American Museum of Natural History.

SIR CHARLES HYDE, proprietor of the *Birmingham Post* and the *Birmingham Mail*, has made a gift of £100,000 to Birmingham University.

THE late M. Douglas Flattery, of Boston, has bequeathed the sum of $25,000 to Harvard University to be added to a trust fund for research in medicine.

PLANS to merge the Armour Institute of Technology with Northwestern University are under consideration. The institute would then become the engineering school of the university.

DR. CARL HEDBLOM, professor of surgery at the University of Wisconsin, has been appointed professor of surgery in the school of medicine of the University of Illinois, Chicago.

DR. H. H. BEARD, associate in biochemistry at Western Reserve University, has been made senior instructor in biochemistry and acting head of the department.

AT Tufts College Medical School, Dr. Frank H. Dunbar has been appointed assistant professor of pathology and Dr. Edwin H. Place, assistant professor of pediatrics.

FREDERICK P. WEAVER has been appointed head of the newly established department of agricultural economics at Pennsylvania State College.

DR. JOSEPH BARCROFT, reader in physiology at the University of Cambridge, has been appointed to the chair of physiology in succession to the late J. N. Langley.

THE vacancy in the Regius Professorship of Physic at Trinity College, Dublin, caused by the resignation of Dr. John Purser, has been filled by the election of Dr. T. Gillman Moorhead, who has been for the last five years King's Professor of Materia Medica.

DR. SERGIO SERGI has been named a titular professor of anthropology at the Royal University at Rome, and director of the Anthropological Institute of the university.

DISCUSSION AND CORRESPONDENCE

TRYPARSAMIDE

THERE has been some discussion as to the parts played by the workers at the Rockefeller Institute and the University of Wisconsin in regard to the initiation of the research on the therapeutic use of tryparsamide in neurosyphilis.[1] Dr. Brown states in his article in SCIENCE of October 16, 1925, that

> ". . . this study was undertaken in response to a specific suggestion based on laboratory and preliminary clinical investigation" and "The connection of the Wisconsin group of workers with the development of tryparsamide was, therefore, essentially the same as that of Alt and other clinicians with the development of salvarsan . . . ."

The obvious implication of these statements is that our study of tryparsamide in neurosyphilis at Wisconsin was initiated at the suggestion of Brown. The fact is that tryparsamide was but one of a considerable number of drugs studied by us in this connection. Of these, only three were obtained from the Rockefeller Institute.

[1] Jacobs, W. A., *Medicine*, 1924, iii, 191. Leake, C. D., SCIENCE, 1925, Sept. 18, p. 251. Brown, W. H., SCIENCE, 1925, Oct. 16, p. 350.

Under date of April 30, 1919, we made an application to the Interdepartmental Social Hygiene Board for an appropriation to make possible "An attempt to prepare mercurial and arsenical compounds which have a predilection for the central nervous system, in the hope of finding drugs more useful than any known in the treatment of syphilis of the central nervous system." This occurred three months before we communicated with the Rockefeller Institute group. The grant was actually made August, 1919. It is obvious, therefore, that our research, directed toward the therapy of neurosyphilis by new chemical agents, was conceived by the Wisconsin workers independently of the Rockefeller Institute group. We knew that the Rockefeller Institute workers had prepared and studied a number of new drugs in animal syphilis and trypanosomiasis. We desired to study their drugs from the viewpoint of neurosyphilis.

On July 17, 1919, we made our first contact with the Rockefeller group of workers, in a letter from Loevenhart to Brown, in which the following statements were made:

"We have received from the Interdepartmental Social Hygiene Board an appropriation of $8,000 for the purpose of investigating improved methods for the treatment of syphilis of the central nervous system. We are very desirous not to spend time or money investigating substances which have been studied, but we should be delighted to start with a full knowledge of the work of Brown and Jacobs so that no time would be lost. *Have you studied the concentration of your various substances in the central nervous system or have you paid any attention to the advantages of your substances in the treatment of syphilis of the central nervous system?* We propose to study the distribution of arsenic in the body quantitatively and to find how such substances tend to be concentrated in the central nervous system. *We would be delighted to begin our study with any substances that you might be willing for us to test from this viewpoint.* It is entirely unnecessary for me to tell you that full and complete credit will be given to you and the institution for everything that you may do, and we desire not to encroach upon your preserves."[2]

In Dr. Brown's reply to this letter, bearing date of July 26, 1919, he stated all the different types of work in which they had been engaged but made no statement whatever regarding any contemplated work on the action of tryparsamide in neurosyphilis. On the other hand, he did state, "In fact, there are a number of substances on our list which I think would furnish material for a profitable investigation of the type which you contemplate. Needless to say, I should be very glad to have you take up any of these substances." The direct question, then, as to the contemplated use of their substances in neurosyphilis was not answered, and they never mentioned at any time in correspondence or conversation that they had contemplated having such a study made.

The Rockefeller Institute at our request submitted three drugs which they were willing for us to study from our viewpoint, *viz.*, neurosyphilis. The conditions under which we worked were defined in a letter from Dr. Simon Flexner to Loevenhart under date of October 29, 1919. He stated, "If you would be interested in testing at your own discretion on animals and even on man such of the drugs as are now available for restricted and controlled use, we would be pleased to have you do so."

These drugs were studied along with many others which were prepared by us or obtained from other sources. One of the substances submitted by the Rockefeller Institute was totally inert, another was too toxic for human therapy, and tryparsamide alone proved to be useful in the treatment of neurosyphilis.

The Rockefeller Institute group, then, produced tryparsamide and thoroughly and carefully worked out its biological action in animals, including its tonic effect, symptomatology, toxicity, therapeutic value in animal syphilis and trypanosomiasis, and preliminary studies in acute and latent syphilis in man. Furthermore, they generally placed at our disposal the three compounds, free of cost, during the entire period of our therapeutic study up to the time of our first publication. They also placed in our hands all the information they had concerning the compounds. This spirit of cooperation shown by them, we are delighted to acknowledge and place on record. The Rockefeller Institute gave no financial assistance for our research.

Tryparsamide was not brought to us with the request that we use it in the treatment of neurosyphilis. We requested that we be allowed to study it along with many other drugs in an independently conceived, comprehensive effort to improve the treatment of neurosyphilis.

The two independent researches on the therapeutic application of new arsenical drugs at the Rockefeller Institute and at Wisconsin converged. Each was helpful to the other and there was a splendid spirit of cooperation. The Wisconsin group is happy in having played any part in this cooperative effort. The significant thing is that a contribution to the treatment of frightful disease has been made; the parts played by the two groups of investigators is of little importance but may be of sufficient historical interest to justify this statement.

A. S. LOEVENHART

DEPARTMENT OF PHARMACOLOGY,
UNIVERSITY OF WISCONSIN

[2] Italics are not in original letter.

IS AN INTERNATIONAL LIST OF GENERA OF CULTIVATED PLANTS POSSIBLE?

FOR three years correspondence has been in progress between about fifty botanic gardens in different parts of the world with a view to a possible simplification of the international exchange of seeds. Expressions have been received from a number of gardens favoring agreement as to genera and families of cultivated plants, as follows:

Kirstenbosch, South Africa: I approve of the formation of an international list of genera of cultivated plants, provided that it is clear that this is entirely for practical convenience, and that it is not intended to be an authoritative work on systematics (*R. H. Compton*).

Melbourne, Australia: We shall be glad to cooperate with other botanical institutions in the formation of an international list of genera of cultivated plants. We follow the Engler system in the Botanic Gardens and National Herbarium. It is the most widely accepted classification and is, I think, the best for general use (*Wm. Laidlaw*).

Montevideo, Uruguay: While we fully accept the position of the International Congress of Vienna, we are forced, in the cases where we can not look into details, that is, in a great majority of cases, to accept names of the Engler system without criticism. Most botanic gardens are probably in the same position. When one once leaves the nomenclature of the Index Kewensis, which is regrettable, one must accept a number of peculiarities of the Engler system, for example the word Thuja, awkward for the Spanish (which is pronounced Thucha) instead of Thuya (which would be pronounced Thuia) (*Luis Guillot*).

Ottawa, Canada: While absolute uniformity is hardly likely to be realized, I think the curators of most botanic gardens will see the advantage of falling in line with the majority. . . . The acceptance of an international list of genera would lead to the uniformity in procedure so much to be desired (*J. Adams*).

Arnold Arboretum, Massachusetts: Generally we follow Dalla Torre and Harms except in cases where we have formed a different opinion. . . . If an international list of genera should be confined to disputed genera, it could easily be printed on a single sheet, and would be convenient to consult, and being inexpensive, would have a wide distribution (*Alfred Rehder*).

Kew, England: The formation of an international list of genera of cultivated plants would serve a useful purpose in tending to promote greater uniformity in nomenclature of cultivated plants (*A. W. Hill*).

Edinburgh, Scotland: I would be in favor of an approved list of *nomina conservanda* which insures the retention of all well-known generic names, the avoidance of subdivision of long established families and genera, and recognition of the difficulty of changing generic and specific names already rooted in horticultural practice (*W. W. Smith*).

Dublin, Irish Free State: I am strongly in favor of the idea of an international list of genera of cultivated plants. So far as our small staff can, we will cooperate with the suggestion (*H. H. Dixon*).

Groningen, Holland: I shall readily accept in the seed list of our garden the use of the names and classification as established by the cooperating institutions (*F. C. Schoute*).

Copenhagen, Denmark: I feel convinced that it would be of real value if all botanical gardens used the same family and generic names, but I am afraid it will be a very troublesome job to unite all gardens in this way (*Axel Lange*).

Lisbon, Portugal: I promise you our cooperation (*R. Palhinha*).

A number of gardens favor adopting exactly the genera of Dalla Torre and Harms, for example:

Delft, Holland: We prefer to take the family and generic names exclusively from Dalla Torre and Harms and to follow the Index Kewensis and Christensen's Index Filicum for the names of species. We still think this the most simple way to come to an agreement (*G. van Iterson*).

Coimbra, Portugal: The system of Engler and the Index of Dalla Torre and Harms are no longer in accord with the latest works of systematists. But a collection of plants can not be changed every year. We are of the opinion that the most simple and most practical is the adoption, in principle, of the names of Dalla Torre and Harms for the Siphonogama, and of Christensen for the ferns. Those who, for systematic or other reasons, wish to use other names, could print these in slightly different characters, or mark them by a conventional sign (*L. W. Carrisse, F. A. Mendance*).

In the hope of aiding progress toward international agreement in this matter the Brooklyn Botanic Garden intends to publish, early in 1926, a preliminary list of about 2,500 genera of plants offered in the seed lists of about a hundred botanic gardens. The names will be printed in large or small type, according to the information we have received, as to whether they are more or less generally acceptable. The list will be mailed to botanic gardens and herbaria, and, on request, to others interested.

ALFRED GUNDERSEN

BROOKLYN BOTANIC GARDEN,
NOVEMBER 25, 1925

NOTE ON THE GEOGRAPHICAL DISTRIBUTION OF THE PROTOZOAN GENUS CRYPTOCHILUM MAUPAS[1]

WHILST working on the Protozoa of Bermuda in the summer of 1919 my attention was called to a parasitic form of ciliate Infusoria found, with others, in great numbers in the intestinal tract of

[1] Contributions from the Bermuda Biological Station for Research. No. 152.

Toxopneustes variegatus, a common form of sea-urchin found in this area. The organism is evidently a species of the genus Cryptochilum, first described by Maupas,[2] but differs in some minor details of structure from Cryptochilum echini described in the paper of Maupas cited. These differences may indicate a new species, but since the life history of the European form has been carefully investigated by Russo[3] (see also Russo[4] and Russo e di Mauro[5, 6, 7]) it seems better to reserve judgment on this matter until the life history of the Bermuda species has been more fully worked out.

Maupas first described the species as occurring in the intestines of several Echini from the coast of Algiers. A little later he opened a large number of Echinus (Strongylocentrotus) lividus and E. melo at Roscoff, on the coast of Brittany, without encountering a single individual infected with Cryptochilum; but four years later he found it again in E. lividus at Banyuls-sur-Mer. He says: "It appears, then, confined to the Mediterranean."

Schewiakoff[8] does not mention this species under the genus Cryptochilum, but all the species that he discusses in his paper are described as occurring in European or African waters.

In a paper by Jacobs,[9] there are briefly described several parasites from the intestinal tract of Diadema setosa, from the coral reefs to the west of the Tortugas. The specimen "D" described in this paper seemed so like those found at Bermuda that I submitted a prepared slide of a specimen to Dr. Jacobs, and he says: "So far as I can tell from the slide which you sent me, the form is at least very similar to the one which I designated as 'D' in my 1914 paper."

Since 1919 I have examined large numbers of different species of sea-urchin at Woods Hole, Mass., and at Beaufort, N. C., but found no infection with Cryptochilum until the summer of 1924, when I had the opportunity of examining a number of Toxopneustes (Lytechinus) variegatus brought up by the dredge of the U. S. Fisheries boat in Core Sound, Beaufort, N. C. All but one of the twenty-two individuals examined were infected with Cryptochilum echini.

Thus, the distribution of this species is far wider than suspected by Maupas. It is not confined to the Mediterranean, being common at Bermuda and at Beaufort, N. C. In all probability it will also be found in the sea-urchins of the West Indian area.

A. W. L. BRAY
RENSSELAER POLYTECHNIC INSTITUTE

[2] Maupas, E., 1883, Arch. zool. exp. et gen., (2), I, 427.

[3] Russo, A., 1916, Monit. Zool. Ital., Firenze, VII, 74.

[4] Russo, A., 1914, Atti Accad. Gioenia Sci. Nat. Catania, (5), VII, Mem. 19.

[5] Russo, A., e Di Mauro, S., 1905a, Boll. Accad. Gioenia Sci. Nat. Catania, ser. nov., fasc. 84, 3.

[6] *Id.*, 1905b. *Ib.* fasc. 84, 9.

[7] *Id.*, 1905c. *Ib.* fasc. 85, 10.

[8] Schewiakoff, W. T., 1896, Mem. Imp. Acad. Sci., St. Pétersbourg, (7), IV, No. 1.

[9] Jacobs, M. H., 1914, Carnegie Instn. Publn., 183, 147.

THE LOSSES IN TROUT FRY AFTER DISTRIBUTION

MAY I ask the cooperation of your readers, fish culturists and anglers in testing the reliability of some experiments which were designed to ascertain the numbers of trout fry which survived out of a given number distributed in depleted trout streams? The importance of the experiments can hardly be overestimated, because if corroboration of the board's results is obtained in different parts of Canada and in the United States, then if economic results are aimed at, fry will have to be rigidly excluded from all waters excepting those which are known to be suitable.

Three public bodies in Canada cooperated in carrying out the experiments during the summers of 1923 and 1924: (1) The Ontario Department of Fisheries, which furnished the fry and fingerlings and in most cases distributed them; (2) the Department of Fisheries, Ottawa, which appointed an experienced hatchery officer to check the determination of losses; and (3) the Biological Board of Canada, which appointed a Mr. H. C. White to carry out the operations in the field.

In seven streams and two ponds, a total of 97,500 fry or fingerlings were planted, some in June of 1923 and some again in June of 1924. In six of the streams the losses were apparently total at the end of three months. In streams and ponds combined, apparently only 1,375 survived, being less than one and one half per cent. of the total fry planted.

The method of determining the losses was that of seining the streams or ponds and counting the survivors. A net fine enough to catch the smallest fry, and long enough to stretch across a brook is used. A stout brail or stick, about three or four feet long, is attached to each end of the net. Heavy leads are fixed to the lower side of the net, so that fry may not escape at the bottom. The upper side is held above the water by the two men who operate the net, one on each side of the stream.

The seining should be done over and over again—a dozen or more times if necessary; in fact, often

enough to ensure that almost every survivor is caught. Towards the end of the seining, it may be necessary to have a third man rile the water thoroughly by stirring up the bottom of the stream in advance of the two seiners. This, in order to prevent the fry from seeing and avoiding the net. Some practice is necessary in seining, otherwise the results will be unreliable.

In one of the brooks seined by the board it was found that the fry ascended the stream about forty rods above and ninety rods below the point of distribution. If it is desired to shorten the distance to be seined and catch all ascending and descending fry, then two fine wire screens should be placed across the stream, one, say twenty to fifty rods above, and the other twenty to fifty rods below the point of distribution. In each of these screens there should be inserted a cylindrical wire fish-trap, funnel-shaped at one end and joined by a smaller cylindrical wire tube or sleeve to an opening in the central part of the screen, so that the trap can be removed and cleaned at pleasure. The screen and the trap should be carefully constructed so as to catch all ascending or descending fry, and thus discover how many fry migrate up or down stream.

The outstanding causes for the high mortality which was found in southwest Ontario seemed (1) warm, stagnant or peaty water; (2) enemy fish eating the fry as shown by finding fry or fingerlings in their stomachs; and (3) lack of sufficient natural food.

The results of the board's experiment thus far are a severe condemnation, not of fish culture as a whole, but of the prevailing method of distributing fry in streams, namely, dumping them at any point most convenient to a highway or traveled road. They should be distributed with fair uniformity along the upper stretches of streams or along the margin of ponds where trout naturally lay their eggs, if they can find suitable spawning beds.

The experiments demonstrate, or at least indicate:

(1) A loss of 98 per cent. of the fry (for the method of planting used and the streams investigated) during the first three months after distribution.

(2) Consequently a greatly increased cost of production per fry.

(3) The necessity of a thorough examination as to the suitability of every stream or pond in which it is proposed to plant fry.

At present we are planting fry in the dark, and in some cases we are feeding them to coarse or useless fish.

A. P. KNIGHT,
Chairman, Biological Board of Canada
KINGSTON, ONTARIO

SCIENTIFIC BOOKS

The New England-Acadian Shore Line. By DOUGLAS JOHNSON, professor of physiography, Columbia University. xx + 608 pages. John Wiley and Sons, New York. 1925.

PROFESSOR JOHNSON'S scholarly volume describing the Atlantic shores between the mouth of the Hudson River and the Gulf of St. Lawrence is the most notable American contribution to the science of physiography of the year if not of the decade. It is the first of a series of "Studies of American Physiography" which are designed to treat in systematic fashion the origin and evolution of the surface features of the continent. In this volume is set forth in most readable style a multitude of facts from which the history of this complex shore line may be deduced. The work is largely based on field studies by its author, but Professor Johnson has drawn widely from all available sources so that the book is a complete treatise on the subject.

A part of the expense of the author's field work was met by a grant from the Shaler Memorial Fund of Harvard University and the book is therefore one of the "Shaler Memorial Series." It is peculiarly fitting that the name of the geologist who devoted no small share of his energies to the elucidation of our coastal phenomena should thus be linked with this monographic study of a region which he loved. It is also appropriate that the volume should be dedicated to William Morris Davis, whose creative work in the study of land forms has done so much to make physiography a science.

There is space here merely to call attention to a few of the many outstanding contributions to physiographic knowledge, which the reader will find in this book. The author reaches the general conclusion that the latest movement of the New England-Acadian coast was a gradual submergence of the land which culminated only a few thousand (perhaps between three thousand and five thousand) years ago. So recent was the movement which brought the sea surface against the land at the present level that the salient features of the initial shore line have not been fully destroyed. The shore line to-day clearly displays a remarkable dependence upon geologic structure. It is in an extremely youthful stage of development, befitting the short interval of time since the present relative position of land and sea was fixed. "The rocky cliffs bordering parts of the Maine and Nova Scotia coasts, the picturesque crags towering high above the waves in the Percé region, and the still loftier scarp along the northeastern side of Cape Gaspé,

as well as the broad, submerged platforms off the latter cape and along the shores of the St. Lawrence embayment, all seemingly attributable to extended erosion of the lands by the sea, are found to be reasonably interpreted as the result of limited modification by marine agencies of forms earlier produced above sea-level by subaerial forces, and only recently brought within reach of the waves."

The series of baymouth bars which border the lowland shores of New Brunswick and Prince Edward Island, the cuspate foreland and bars of the Bras d'Or and Narragansett lowland shores and a great variety of spits, tombolos and other wave-built features are described. These shores are in a more advanced stage of development than those which margin the crystalline uplands, but they are interpreted as implying similarly a relatively short stand of the sea at the present level. The conclusion that the waves have worked at the present sea-level for only a very short time is further strengthened by a carefully detailed study of submarine topography which indicates that little progress toward the establishment of a profile of equilibrium has been made.

At certain localities there are elevated strands which record a moderate emergence of the land, and along certain parts of the coast a narrow coastal plain of glacial and post-glacial date has been raised above the water. The validity of many of the supposed elevated shore lines is, however, questioned. Elsewhere minor submergence has added slightly to the embayment of the coast and has drowned the lower portions of some of the valleys cut into the narrow coastal plains, but the essential character of the shore line has remained unmodified by these subordinate changes of level. The shore line as a whole may therefore be classified as a shore of submergence. Its critical analysis includes the recognition of its initial form and the changes subsequently introduced by wave erosion and deposition.

Considerable space is given to a consideration of the rectilinear shore lines displayed at several points along this portion of the Atlantic coast. It is shown that the theory of a geometric network of parallel and more or less regularly spaced systems of extended earth fractures does not seem to apply. A number of fault-controlled shore lines are recognized, but the great majority of rectilinear shores are attributed to other causes than faulting.

The conclusion is reached that the New England-Acadian shore line was but little affected by glacial erosion, although profoundly modified by glacial deposition. With the exception of the Mount Desert Island embayments of Maine and the drowned gorge of the Hudson River, true fjord coasts are practically non-existent in this region. On the other hand, the moraines, outwash plains and drumlins of the Pleistocene ice sheets are bordered by characteristic and strikingly different shores.

The problems connected with present changes in the shore line resulting either from changes in level or from the activity of waves and currents are critically reviewed. The conclusion is reached that during the last few thousand years there has been no appreciable change in the relative position of land and sea. Failure to discriminate carefully between fictitious appearance of modern subsidence and the real effects of the more ancient submergence has led to a widespread misapprehension concerning recent changes of level along the Atlantic coast. The great need of more accurate data than are now available for calculating changes in the position of the shore line is emphasized. From the data at hand the present rate of wave erosion is estimated to cause a retreat of shore cliffs amounting to three, five and even ten feet per year. Making due allowance for changing conditions in the future, Professor Johnson calculates that the outer part of the forearm of Cape Cod will disappear within the next four or five thousand years.

Considerable attention is paid to the analysis of the submarine forms bordering the land, an analysis which bespeaks the hand of a master in the study of shore lines. The fishing banks extending from Cape Cod to Newfoundland, and including the Gulf of Maine on the southeast, are identified as the several parts of a typical coastal plain cuesta, now completely submerged, while the gulf itself represents a more deeply submerged inner lowland like that associated with the Atlantic Highland cuesta of the Atlantic plain in New Jersey. Subordinate cuestas parallel to the major "Banks cuesta" are found on the floor of the drowned lowland and a great fault-line scarp, in places double and triple and apparently 350 miles in length, is traced beneath the waters of the gulf from the head of the Bay of Fundy to a point off the Massachusetts coast. This "Fundian fault" appears to be one of the important fracture lines of North America, well deserving of much more detailed study than is possible with the present scanty data concerning ocean depths in the Gulf of Maine. Some years ago Woodworth had suggested from his study of New England earthquakes the probability that a fault existed along or off the coast, which was responsible for several of the quakes, such as those of 1638, 1727 and 1755. Although no definite connection between the "Fundian fault" and such an earthquake as that of January 7, 1925, can at present be established, the recent seismic activity in northeastern North America serves among other things to focus the attention of seismologists and physiographers alike upon this study of submarine geologic structure.

Contrary to the widespread conception that the Atlantic continental shelf extends seaward approximately to the one hundred fathom line, Professor Johnson finds that the margin of the continental platform is only a few fathoms below sea level off Florida, is from twenty-five to thirty-five fathoms deep off Georgia and the Carolinas, forty to forty-eight fathoms opposite Maryland, forty-eight to fifty-five off the New Jersey and Long Island coasts and sixty to seventy fathoms deep at the outer edge of the Banks. The margin of the shelf certainly pays scant attention to the one hundred fathom depth at which it is traditionally supposed to occur and apparently was not developed with respect to the present relative position of land and sea. On the contrary, the author concludes from the depth of the floor of the submerged lowlands in the Gulf of Maine that the depth of submergence for New England is at least as great as twelve hundred feet.

Although primarily of interest to the specialist in geology and geography this book will undoubtedly make an appeal to a wide range of readers. The discussion of the submarine physiography of the Gulf of Maine and the Newfoundland Banks leads to an apt suggestion concerning the route and time of migration of the peculiar coastal plains flora which Professor Fernald has been investigating during recent years in Acadia and Newfoundland. Those interested in coast protection and marsh reclamation will find much of interest and of value. In fact, all who love the sea and the forms it fashions along the land will find answers to many of the questions they have frequently asked about our coastal scenery.

So far as Professor Johnson's deductions are concerned, it is probable that in the main they will meet with the general approval of those competent to pass judgment upon them. On the other hand, the assertion that this portion of the North American shore line is now stationary with respect to sea-level and has remained so during the few centuries of historic occupation will doubtless meet with opposition. The rather widespread view that this coast is now sinking at the rate of a few inches per century must certainly be looked upon with suspicion on account of this and other of Professor Johnson's publications, but it can not be said as yet to be disproved. More facts are needed before certain conclusions are justified; perhaps these will be forthcoming in the same author's projected volume on "The Coastal Plain Shoreline." In the meantime, geologists and geographers are deeply indebted to Professor Johnson for this stimulating and scholarly publication.

KIRTLEY F. MATHER

HARVARD UNIVERSITY

SPECIAL ARTICLES

A NEW TYPE OF GASEOUS CATALYSIS

IN SCIENCE[1] of November 6 a preliminary account was given of certain organic gas reactions produced at ordinary temperature by the ionizing action of radon. In the last paragraph of that paper announcement was made of the discovery that nitrogen ions (N_2^+) have the same power of causing the polymerization of acetylene of cyanogen and of hydrogen cyanide, as do their own ions $C_2H_2^+$, $C_2N_2^+$ and HCN^+, respectively. Since nitrogen, although exerting this accelerating influence, did not itself in any case enter into permanent combination, we termed the effect *"ionic catalysis."*

It appeared important to find how general this effect of inert gases might be. Therefore *helium, neon* and *argon* were separately mixed with acetylene and a small quantity of radon was introduced as ionizing source. In all three cases the results were the same as for nitrogen; the ratios $\frac{-M_{C_2H_2}}{N_{(C_2H_2+He)}}$, $\frac{-M_{C_2H_2}}{N_{(C_2H_2+Ne)}}$ and $\frac{-M_{C_2H_2}}{N_{(C_2H_2+A)}}$ were all initially equal to about 20, the value for $\frac{-M_{C_2H_2}}{N_{C_2H_2}}$ in the case of pure acetylene. This value is maintained even when the ionization of the inert is as much as 50 per cent. of the total. The specific ionizations relative to air are: $i_{He}=0.211$; $i_A=1.25$; i_{Ne} (estimated by interpolation from He and A) = 0.75. By assuming $\frac{-M_{C_2H_2}}{N_{(C_2H_2+Ne)}}=19.6$, and calculating backward, we predict i_{Ne} = 0.75. No experimental value for i_{Ne} was available.

Having thus shown the effect to be quite general for inert gases, we desired to see if it is confined to polymerization of triple bond compounds like C_2H_2, C_2N_2 and HCN. We, therefore, compared the rates of combination of $2H_2+O_2$ with and without the presence of nitrogen. Again the nitrogen ion contributed just as much to the reaction velocity as the O_2^+, H_2^+ and O_2^- ions do. Since the ionization of N_2 is almost double that of electrolytic gas when they are mixed in equal proportion, $1N_2$ to $1(2H_2+O_2)$, the reaction rate would be expected to be nearly 3 times as fast as if N_2 were absent, which was found experimentally to be the case. Or $\frac{M_{H_2O}}{N_{(O_2+H_2+N_2)}}=4=\frac{M_{H_2O}}{N_{(O_2+H_2)}}$. Incidentally, this indicates that not only the N_2^+ ions are effective but all the free electrons from these N_2^+ ions are trapped by O_2 to form 0_2^- ions, which are

[1] SCIENCE, 62, 422 (1925).

also equally effective (compare J. Am. Chem. Soc. 47, 2678 (1925)). Argon when mixed with electrolytic gas also was found to have a positive catalytic effect, though less than that of nitrogen.

The generality of the effect having been thus extended, the question arose as to why CO_2 when generated in other reactions had failed to show a similar catalytic effect. Is the exception peculiar (1) to CO_2, or (2) to the systems in which it has been generated, or (3) to both? To settle (1), CO_2 has been used in acetylene polymerization and in water synthesis with the following results: $\frac{-M_{C_2H_2}}{N_{(C_2H_2+CO_2)}} = 17.4$, at a point in the reaction where 55 per cent. of the positive ions are CO_2^+. While it thus appears that CO_2 acts quite normally as an inert ion catalyst, about 10 per cent. of CO_2 was found to be lacking in the gas phase at the end of the reaction when C_2H_2 was completely exhausted from an initial (1:1) mixture. Whether this amount of CO_2 had reacted chemically has not been determined. In the system $1(2H_2+O_2)+1CO_2$, carbon dioxide did not prove to be inert. The entire rate of reaction was accounted for as the sum of the known rates of the separate reactions: $2H_2+O_2$ and $2H_2+CO_2$. (*loc. cit.*)

To settle (2), argon has been used as inert catalyst in the reaction $2CO+O_2=2CO_2$, where CO_2, although produced by the reaction, fails to accelerate it. Argon was found to catalyze the reaction, but less than the normal, just as it was found to do in the oxidation of hydrogen.

In discussing these results, Professor K. T. Compton proposed a very interesting hypothesis, namely, that when the inert gas has a higher ionization potential than the reacting gas has, the positive ion of the inert upon colliding with the neutral reactant molecule will ionize the latter by taking away an electron from it; for example, with neon and acetylene, $Ne^+ + C_2H_2 = Ne + C_2H_2^+$. The $C_2H_2^+$ then behaves just as if it had been originally formed by an alpha-particle collision. This would explain at once why the inert ions have the same power of producing polymerization as have the primary ions of the reactant. The catalytic reactions so far considered conform generally with this principle—but it will be possible to give it a severer test by choosing inerts with ionization potentials definitely lower than those of the reactants. Then there should not only be no positive catalysis, but a high degree of negative catalysis by the reverse process.

The question resolves itself into a fundamental one of the properties of gaseous ions. When the positive ion of the inert gas meets a neutral molecule, do they exchange the positive charge, or do they unite and form a clustering center? Or, putting the question another way: Does the ion of the inert revert to the neutral state upon first effective collision with the reactant, or not until after clustering is complete and electrical neutrality is reestablished by the return of an electron? Professor Compton has volunteered to approach the question from the physical side and we have planned a series of experiments which ought to afford a decision through the chemical evidence to be obtained. A more extended discussion will be postponed, awaiting the new results.

S. C. LIND,
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FIXED NITROGEN RESEARCH LABORATORY,
U. S. DEPARTMENT OF AGRICULTURE,
WASHINGTON, D. C.

CONCENTRATION OF THE GROWTH-PROMOTING PRINCIPLE OBTAINED FROM YEAST. (VITAMIN B.)

IT was reported in our previous communication[1] that the growth-promoting principle present in the brewers' yeast could be prepared in a form which was in a unit weight approximately 2,000 times stronger than the dried yeast itself. The substance was still a complex mixture. Further purification was made difficult by the fact that the process was accompanied by large losses of active material. It was urgent therefore to seek for a more economical method of concentration. Such has now been developed.

In only three steps a material is obtained which is equal in potency to the material previously described and which is associated with a loss of only 50 per cent. of the original material. The starting material is the fraction of yeast extract prepared according to Osborne and Wakeman. The aqueous solution of this material is brought to pH = 4. Some inert material settles out. From the solution the active material is precipitated with alcohol. The solution of this material is treated with nitrous acid and by this treatment a substance is obtained which is active in daily doses of 0.0018 gm. The maximum loss in active units is 10 per cent. Often such material is prepared without any loss in active units. The composition of this material is C = 38.2, H = 6.0, N = 10.3, P = 7.6, S = 1.46, NH_2.N = 0. The sulfur was present mostly in the form of – SH groups. From this material the active principle was extracted with silica gel. From the gel by extraction at pH 9.5 a material was obtained which was active in daily doses of 0.00008 gm. The material contained about 4 per cent. of sulfur. The white rat was used as the experimental animal.

P. A. LEVENE,
B. J. C. VAN DER HOEVEN

[1] Levene, P. A., and van der Hoeven, B. J. C., *J. Biol. Chem.*, xlv, 483 (1925).

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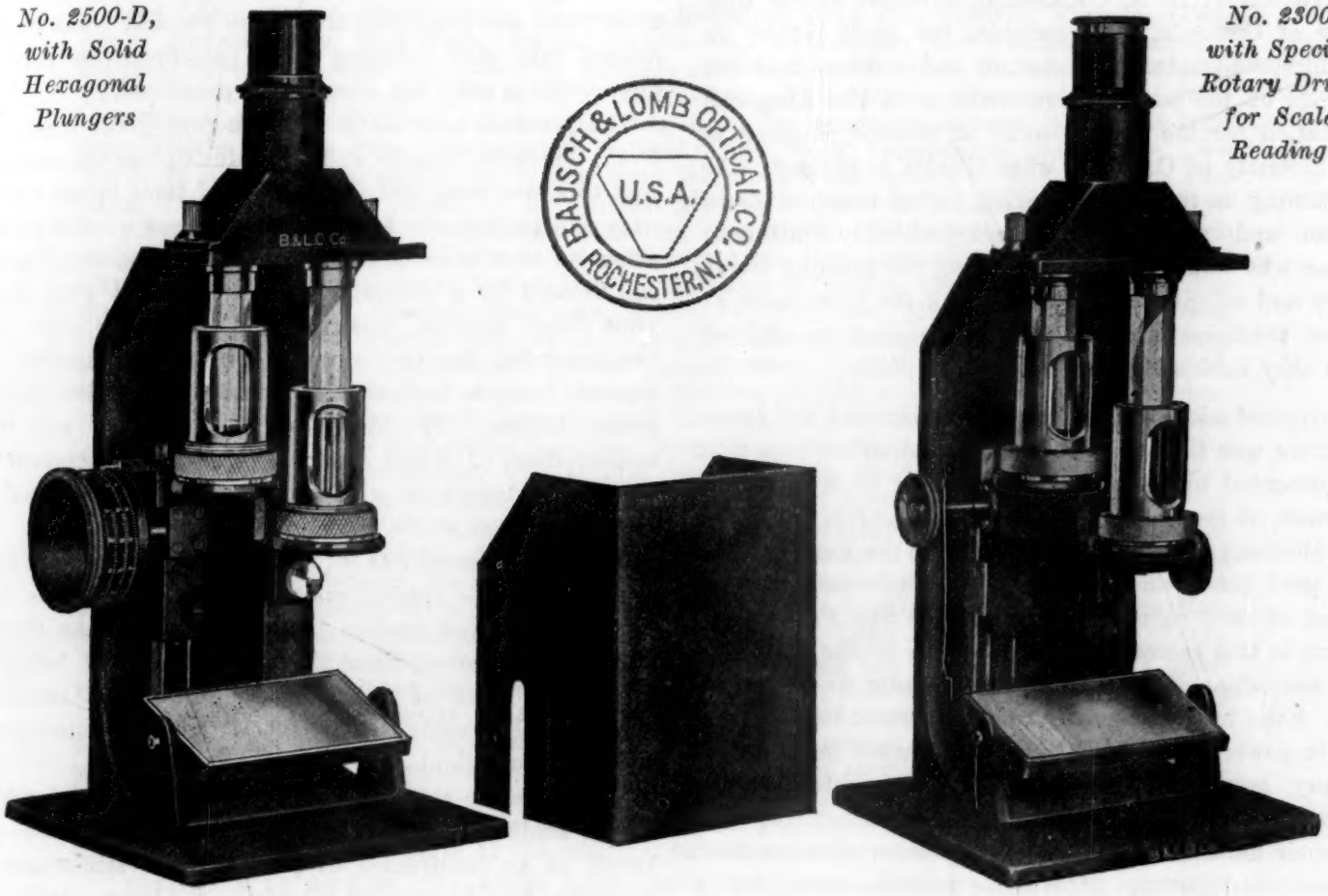

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SCIENCE NEWS

By Watson Davis, Managing Editor of Science Service

PAPERS AT THE BOULDER MEETING OF SOUTHWESTERN DIVISION OF THE AMERICAN ASSOCIATION

PROFESSOR T. D. A. COCKERELL, zoologist of the University of Colorado, who resembles the great Huxley in his widespread interest in nature and science, told the scientists of the southwestern division of the American Association for the Advancement of Science, meeting at the University of Colorado, what Huxley might say if he were among us to-day. Referring to fundamentalists in religion and science, Professor Cockerell continued: "Those who would insist on confining the growing living science and religion of the day within the boundaries of ancient tradition are themselves the wasters of that which they hold most precious."

Contrasted with this modern attitude toward the forces of nature was the study of ancient Indian religion that was presented to the scientists on behalf of Kenneth M. Chapman, of the School of American Research, Santa Fé, New Mexico. Through many centuries the Zuni Indians have used the form of the bird on their pottery as a method of sending their prayers to the Sky Father. So ancient is this custom that the pictures of the bird have been conventionalized until they are hardly recognized as such. Even to-day there survives the ancient belief in the mythic power of all bird kind which acted as an intermediary between the Indian and the mysterious sky forces. In some cases these distorted bird symbols have lost their names among the Indian women who use them in decorating pottery. "We like to make them," they say in explanation when asked why they continue to use these designs, "because our mothers did."

Why some parts of the body are invaded by disease germs and others are not was stated by Dr. Elliott C. Prentiss, of El Paso, Texas, in his presidential address, to be one of the most important medical questions now awaiting solution. He pointed out that in tuberculosis, a disease of great interest to the Southwest, lungs, pleurae, larynx, brain and bones are most frequently attacked by the bacillus, while the tissue of the human body that is least often infected is that of the muscles. This is true in spite of the fact that the germ gets into the general circulation of the blood and goes impartially to all parts of the body. A method of treatment of tuberculosis based on this differential immunity may be evolved, Dr. Prentiss said, and he announced that some experiments were in progress. After attempting the immunization of guinea pigs with injections of muscle tissue and after trying the injections on himself, he applied the new method to several adyanced human cases of tuberculosis with inconclusive but promising results.

Evidence that a race of prehistoric Americans closely related to the ancient peoples of Australia and Melanesia existed in the great American Southwest about two or more millenniums before Christ was presented by Professor E. B. Renaud, of the University of Denver, who by careful measurements of human skulls unearthed from ancient graves discovered only during the last two and three years has concluded that these peculiar relics of an extinct race give evidence of a paleoamerican culture more antique than any heretofore recognized.

The junction of what is now the four great states of Utah, Colorado, Arizona and New Mexico was the country that this race inhabited. The ruins of their burial caves, sites and implements have caused portions of this paleoamerican race to be called the basketmakers, but Professor Renaud by a comparison of their skulls with those from South America, Australia and the islands near Asia has concluded that they were of a race that preceded the Pueblo Indians and also antedated the better known plains Indian. The American basketmakers with the similar races of South America formed a substratum of aboriginal Americans with long narrow heads instead of the broad heads of the later Indians.

Professor Renaud was led to his results by the fact that the heads of the ancient race were not deformed or flattened at the back portion like the crania of the Pueblo Indians. Moreover the skulls give evidence of being so similar to those of primitive Negroid and Australoid races that Professor Renaud labels them as protonegroid and protoaustraloid.

Whence came this race? From the close relationships of the skulls Professor Renaud concludes that it was the result of an infiltration of peoples from somewhere in southern Asia by way of Siberia and Alaska. Probably different branches of migrants at somewhat different times went into northeastern North America and into South America, for in these localities the undeformed skulls are also found. The heads of the paleoamericans were not flattened due to the fact that unlike the Pueblos they used a soft cradle board upon which to carry their young.

Other ancient inhabitants of western America, the oldest ant and the oldest wasp known to the world, were described by Professor T. D. A. Cockerell, of the University of Colorado. Nature embalmed these insects many millions of years ago in the oil shale beds of Eocene age that occur over a very large area of Colorado, Wyoming and Utah and they have just been dug out.

"The ant represents a primitive type allied to certain ants of Australia, but the wasp has a very modern aspect, not differing materially from those which may be caught in Colorado to-day," Professor Cockerell explained. "Thus we are sure that the wasps must have originated very much earlier. No butterflies or bees have yet been found in the oil shales, but we have many beetles and beautiful butterfly-like Homoptera, resembling kinds now inhabiting India."

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More than a thousand kinds of fossil insects have been discovered in the Miocene Florissant beds near the base of Pike's Peak, but strangely no trace of the near relatives of the common house fly, stable fly or blue-bottle fly have ever been found. But Professor Cockerell has unearthed four different kinds of tsetse flies, a genus no longer existing in the northern hemisphere, but practically the same as the deadly insect that spread sleeping sickness among men and cattle in Africa to-day.

A warning against the further destruction of wild animals and fishes and the pollution of the rivers and streams was sounded by Dr. Henry B. Ward, of the University of Illinois, in an address. Many species of fishes and animals are about to disappear from the face of the earth, he said, just as the last fifty years has seen the disappearance of large numbers of wild animals on land, birds in the air and fish in the water. Not only does man's destruction include large animals and other fauna, but it menaces worms, insects and minute organisms in ponds and brooks necessary to keep nature in a state of balance. It is just as bad to pollute the water highways or rivers with city sewage and manufacturing wastes as it is to pitch trash and filth into the public highway or city street.

The planet Mars supports life and enjoys a temperature that at times ranges from 50 to 60 degrees Fahrenheit, according to the conclusions of a paper presented by Dr. A. E. Douglass, professor of astronomy at the University of Arizona.

Measurements at two large observatories showed that there is sufficient heat on the earth's next-door neighbor in the solar system to allow some sort of organic life to grow there and at two other observatories distinct photographs of the markings on Mars were obtained at the time of the planet's close approach to earth last summer.

"These new facts do not mean that there is intelligent life on Mars, like the hypothetical Martians of fiction, but we do find that conditions are favorable to the existence of some low type of living matter, probably vegetable."

The temperature measurements were made by C. O. Lampland at the Lowell Observatory at Flagstaff, Ariz., with the cooperation of Dr. W. W. Coblentz, of the National Bureau of Standards, and at the Mount Wilson Observatory. Dr. Douglass, working at the Steward Observatory, of which he is director, and astronomers of Lick Observatory, California, independently photographed the disputed markings on the surface of the planet through the use of specially sensitive photographic plates.

After using ordinary plates in attempts to record the Martian landscape, Dr. Douglass discovered that special plates, sensitive only to light longer in wavelengths than the red we see with our eyes, would demonstrate the markings with greater distinctness and contrast than even the eye could distinguish. That the failure of the ordinary photographic plate to record the Martian markings is due to the fact that the atmosphere of Mars scatters the blue light to which the ordinary plate is most sensitive was proved by Dr. Douglass by experiments in photographing Arizona mountains through his astronomical telescope. Selecting a hill about five miles away he found that ordinary photography did not bring out details while red-sensitive plates make the trees and rocks stand out like a close-up photograph.

Dr. Douglass has also seen the neutral dark area near the equator of Mars turn to an unmistakable green as the Martian caps became smaller, presumably due to the melting of snow and the consequent growing of vegetation spurred on by moisture.

The planet Venus is the only rival to Mars and the Earth in the possibility of supporting life, but since its surface is continually cloud-covered Dr. Douglass is doubtful how soon we shall be able to investigate this point.

Often the supposed desert spaces on Mars can be seen tinted with red and Dr. Douglass has concluded that this is due to the presence of iron, just as deserts and waste lands on earth are known to owe their ruddy cast to colorful compounds of this plentiful element.

In fact, coloration due to iron brings about a kinship of the "Garden of the Gods," the familiar red barn, Martian deserts and Indian pottery. For Professor Frank E. E. Germann, of the University of Colorado, through chemical analysis has found that the Indians utilized the iron ore, hematite, for the red pigment of their pottery and the iron compound, magnetite, as the black pigment. He declared that the use of these two oxides of iron should be regarded as notable scientific achievements of the Indians and evidence that the cheap barn paint of to-day dates back to the American aborigines.

A new disease attacking the alfalfa fields of Colorado was reported by Professor L. W. Durrell, of the Colorado Agricultural College. It is a bacterial root rot that occurs in them when the plants are three or more years old.

Interesting evidence that a microorganism can become the factory for the growth promoting vitamin B needed by man and animals for healthy existence was presented by Professor Robert C. Lewis, of the University of Colorado School of Medicine. He found that rats deprived of the vitamin but fed on a day-old growth of colon bacilli thrived happily and concludes that the germs actually make the vitamin.

ITEMS

An all-American cold cure, based on home-grown menthol, is a possibility held out by the Bureau of Plant Industry of the U. S. Department of Agriculture. Inasmuch as menthol is now imported at a cost of more than a million dollars annually, government botanists point out that menthol-bearing mint plants can be made a profitable crop if properly cultivated in regions where the climate is suitable. Experimental plantings in various parts of the United States during the past year have shown that the mint does not produce a high enough percentage of menthol in southern states, but in the cooler and moister northern states its culture can be made to pay.

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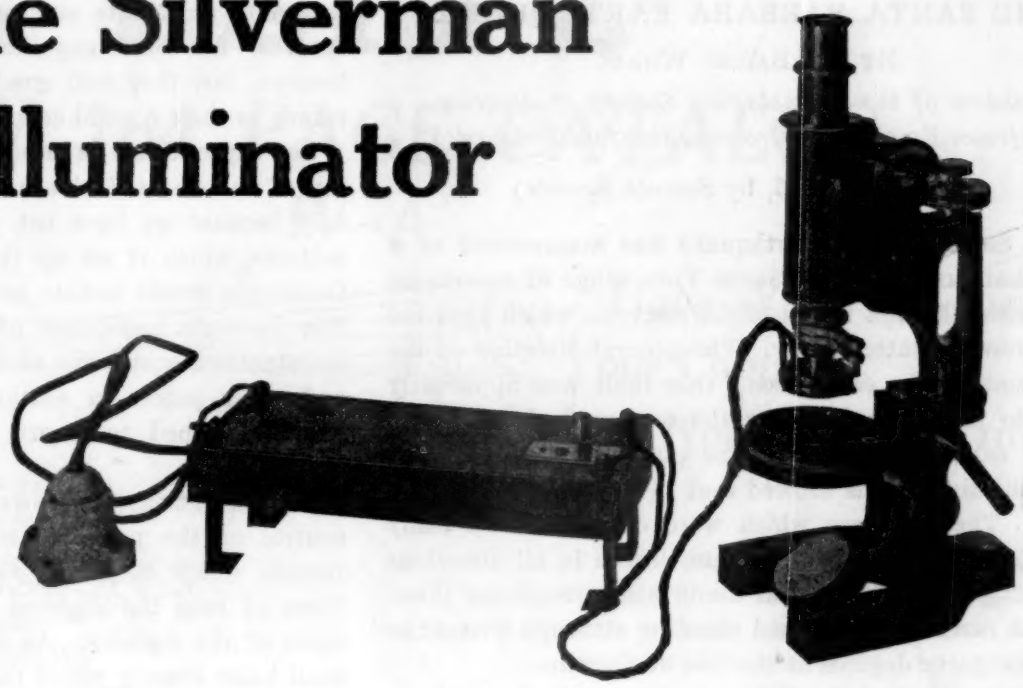

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SCIENCE NEWS

Science Service, Washington, D. C.

THE SANTA BARBARA EARTHQUAKE

By Dr. Bailey Willis

President of the Seismological Society of America, Professor Emeritus of Geology, Stanford University

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The Santa Barbara earthquake was a movement on a fault that runs along the Santa Ynez range of mountains and passes through the Sheffield reservoir which held the city's reserve water supply. The general direction of the movement of the earth along this fault was apparently south to north, as shown by the scar made by the trail of the cannon mounted on the platform near the post office building. This showed that it moved sixteen inches south. The chimneys which were demolished on many houses, otherwise uninjured, were thrown in all directions according to the mechanical conditions surrounding them. In some cases they remained standing although twisted as much as thirty degrees at the line of fracture.

An inspection of the damage in Santa Barbara shows that the lessons of the San Francisco and Tokyo earthquakes could be applied here. I drove through the city within an hour after the shock and noted the buildings of various kinds—wood frame, brick, reinforced concrete, etc. Those that remained undamaged were well constructed. Badly designed reinforced concrete failed, as shown by the distastrous collapse of the San Marcos office building, an edifice of four stories in which one corner gave way. Brick veneers which were not tied to the frame fell out, as in the case of the California hotel, where the floors remain standing, although stripped of walls on three sides. In general good design and honest workmanship stood, while incompetency and bad workmanship were exposed in all their miserable nakedness.

The earthquake was not unexpected among seismologists. During the last seven years we have had the San Jacinto, Inglewood, Elinore and San Bernardino shocks, each one resulting from movement on one of the four great earthquake faults of southern California. The system of faults which outlines the San Gabriel range extends west through the Santa Paula Valley and skirts the Santa Ynez range had not, up to this time, shown any evidence of disturbance. It was well known, nevertheless, that a strong pressure exerted against the mountain range from the south has caused it to move gradually, so that Gaviota Peak, a triangulation point of the U. S. Coast and Geodetic Survey, has been pushed northward twenty-four feet in thirty years. As the last great earthquake shock in this region occurred sixty-eight years ago, in 1857, those who are familiar with the history of earthquakes in California expected a disturbance.

To a certain extent their expectations are now fulfilled, but fortunately the Santa Barbara earthquake is much less severe and much less general in effect than some seismologists have feared it might be. There is now little reason to anticipate any severe shock in the immediate future. We shall experience the usual crop of after tremors, but they will gradually die away as the rocks return to their normal condition of elastic strain.

The expectations of seismologists in regard to the coming of the Santa Barbara shock were of general nature only because we have not yet established the recording stations, which if set up throughout the coast region of California would enable us to foresee such occurrences. The Carnegie Institution of Washington is now engaged in establishing stations at Pasadena, Riverside, La Jolla and other points in southern California, where instruments designed to record local earth tremors will be set up.

All the stations will operate in unison under the central control of the principal stations at Pasadena and the records which they will yield will enable us to fix the focus of even the slightest tremors within fifty or sixty miles of the stations. As the records are continuous, we shall know exactly where the earthquake strain is gathering and how it increases or diminishes from day to day or month to month.

In the course of time a chain of stations of this character will no doubt be established from San Diego to the Oregon line. But it will have to be done through the cooperation of the communities interested and will not be accomplished until public opinion is educated to an understanding of the advantage of knowing all that we can about earthquakes and the methods of protecting ourselves against their effects.

NOTES ON THE SANTA BARBARA EARTHQUAKE

By Watson Davis

Managing Editor, Science Service

Again Mother Nature has had growing pains and again it is demonstrated that man does not learn by experience.

For while the delightful Pacific coast town of Santa Barbara is in ruins, without water, gas or electricity, while the whole length of its principal State Street is practically wrecked, there are some buildings that are essentially undamaged. Those buildings that came through their serious shaking nearly unscathed were those that were built well.

The lesson that can be learned from the disaster here which I have just witnessed is that in areas subject to earthquakes, engineer, architect, contractor and owner must insist that the structures that they erect must be as nearly earthquake-proof as modern engineering can make them.

This is a lesson that should have been learned from the disasters at San Francisco and Tokyo. Unfortunately, it will probably require many more earthquakes, many of them of much greater severity than this one, to cause men

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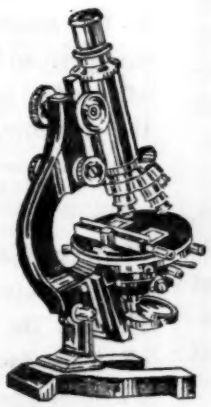

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to refrain from erecting death traps over their very heads. For earthquakes will continue to occur in California as well as in other parts of the surface of the globe.

Near the railroad station, at 6:44 A. M., there was a handsome hotel, recently erected at a cost of some $200,000. At 7:04 its guests found themselves exposed to public view on three sides of the structure. The shock had simply sliced the brick walls from the frame of the building. Such instances may be multiplied many times.

Yet Professor Bailey Willis, president of the Seismological Society of America, who was in Santa Barbara and experienced the quake, says that it was a moderately severe, but not a very severe, shock, and that it was not a shock in which any decently built house should come down.

That the shaking was comparatively slight I can personally attest, for I had the great privilege of going through this earthquake totally unconscious of what was happening. I was asleep. I was on the last overnight Southern Pacific train to pass through Santa Barbara before the shock. At the instant of the first shock this train had reached three miles south of Santa Barbara, where it was nearly derailed by the force of the earthquake. The engineer stopped until the six severe shakes within nineteen minutes had passed away, and then proceeded cautiously toward Los Angeles. I supposed that the motion was due to normal train operations and slept through it all. The reports of the other passengers caused me to hurry back to Santa Barbara on the first Red Cross relief train leaving Los Angeles.

One eminent geologist, Professor Bailey Willis, has already made a rapid but careful investigation of the disaster and his results are given in a signed article written exclusively for *Science Service*. Dr. Arthur L. Day and Dr. H. O. Wood, in charge of the earthquake investigations of the Carnegie Institution of Washington, with headquarters at Pasadena, are now *en route* to the disaster scene.

In spite of the coincidence of the two earthquakes, seismologists state that there is no relation between the Montana shocks of Saturday and Sunday, and those at Santa Barbara. Both of these disturbances will, however, be the subject of detailed investigation by competent scientists.

THE CAUSES OF EARTHQUAKES

EIGHT to ten thousand earthquakes are recorded every year in various parts of the world, and probably four times as many as this occur, but far from being alarming this is a very reassuring fact, Dr. William Bowie, of the U. S. Coast and Geodetic Survey, told representatives of *Science Service* recently. This is because the earth is thus shown to be a body capable of yielding to stresses and strains. If it were not the case, the strain would accumulate until great enough to produce disruptions far more violent than any that have ever occurred, and perhaps sufficient to wipe out all the works of man.

While the earthquake in California followed so closely upon the heels of the one in Montana, this is only a coincidence, said Dr. Bowie, and there was no direct connection between them, except that the shock of the Montana quake might have been the trigger to set off the one in California. This could not have occurred, however, unless the conditions had been ready for a tremor, and any one of a number of things might have been the last straw. Dr. Bowie thinks it possible that the rising of the tide might do it, as a depth of water of only eight feet, when extended over an area of hundreds of square miles, would exert a pressure of millions of tons.

The real cause of earthquakes, he said, is erosion, by which rains carry soil from mountains to valleys, and sedimentation, by which rivers and streams carry material to their mouths and deposit it there. These work gradually, but in time the amount of material moved is enormous, and the distribution of weight on the earth's surface is greatly altered. Because of the earth's ability to yield, the crust gives, and a fault, or crack, develops, along which future quakes may occur. A recognized fault passed through Santa Barbara, and is shown on a map issued by the Seismological Society of America showing the California faults. The Santa Barbara fault was supposed to be dead, however, as no tremor had occurred along it within historic times. The famous San Andreas fault, which caused the San Francisco earthquake in 1906, extends for many hundreds of miles, but does not pass near Santa Barbara.

In spite of the great damage done by the California shake, it was not nearly so violent as the one in Montana, said Commander N. H. Heck, in charge of the Coast and Geodetic Survey's seismological investigations. This was indicated by the seismographic records obtained by the survey's stations at Cheltenham, Md., and Tucson, Ariz., as the records of the Montana quake were much more distinct, and was borne out by the reports of the area affected. In California, only about four counties felt the tremors, while three states besides Montana were shaken.

ITEMS

THAT the monkey has a true color sense has been demonstrated by a series of experiments reported by J. A. Bierens De Haan in an article in the forthcoming issue of *The Journal of Comparative Psychology*. At the Physiological Institute of the Free University at Amsterdam, Holland, Mr. De Haan carried out 3,100 experiments with one monkey and 800 with another to determine their abilities to distinguish between different colors. Colored papers were used, and the monkeys were found to be able not only to distinguish red, blue, green and yellow papers from each other, but also to distinguish the colored ones from each of a series of thirty gray papers ranging in continuous gradation from white to black. Factors such as special smells, texture differences between the colored and gray cards, and special marks on the cards were carefully avoided so that the monkeys would not be influenced by anything other than differences in color.

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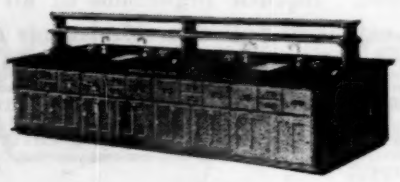

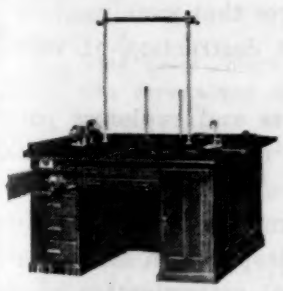

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SCIENCE NEWS

Science Service, Washington, D. C.

THE RESOURCES OF THE PACIFIC OCEAN

A BILLION dollars annually is the wealth that the Pacific Ocean should yield to man provided man takes the trouble to properly conserve and regulate the utilization of the natural resources of the sea. According to Dr. Barton Warren Evermann, director of the museum of the California Academy of Sciences, the only way in which this income from the sea can be obtained is through the restoration of the fur-seal herds of the south Pacific and Antarctic. And this is to be accomplished by an international agreement among the maritime nations of the world.

"The aquatic natural resources of the Pacific are many and enormously valuable," Dr. Evermann explained. "They consist of the marine mammals of which there are between forty and fifty species, including fur-seals, whales and sea otters; the food fishes, such as salmon, cod, herring, halibut and tuna; the invertebrates, such as oysters, clams, possessing great possibilities, and a great multitude of miscellaneous animals and plants, as sea turtles."

The aggregate annual product of these various resources can easily be made to reach fully one billion dollars, when proper fishery methods and conservation measures are enforced. The fisheries for many of these resources are carried on outside of the three mile limit where there can be no restriction except through international agreement. The result has been that many of these resources, such as fur seals, sea otters, whales and others have in many places been already reduced to commercial extinction.

In the north Pacific are three species of fur seal—one belonging to Japan, one to Russia and one to the United States. The Alaska or American herd is the most important. When the United States came into possession of this herd in 1867, there were probably 3,000,000 seals in it. Our government gave to the Alaska Commercial Company the exclusive right to kill the seals. The fur seal is highly polygamous; one male to every 40 or 50 females is all that is necessary for breeding purposes. As the young are equally divided between the sexes it is evident that for every forty males born thirty-nine are not needed for breeding purposes and can therefore be killed for their skins.

Under the lease of the Alaska Commercial Company they were able to kill about 100,000 of these surplus males every year without diminishing the size of the herd. So long as this selective killing was done the herd remained normal in size.

But in the early eighties certain people from Victoria and elsewhere discovered that they could go out in boats, intercept the seals in their return migration, and kill enough to make the business very profitable. They could not select the males for killing; the majority of those they killed were females and that meant the killing of the breeding stock. As a result, the herd decreased rapidly so that by 1912 there were only about 127,000 left. The herd had almost reached commercial extinction.

Subjects of Great Britain and Japan were the ones chiefly engaged in killing seals on the high seas, and the United States appealed to those countries to enter into a treaty with the United States by which pelagic sealing would be unlawful. To induce those countries to do that, the United States offered them each fifteen per cent. of all the seals we would kill on our islands. They accepted the offer, signed the treaty, and pelagic sealing stopped in 1912. Since then the herd has increased from 127,000, in 1912, to over 700,000, in 1924, and the government is now able to kill 25,000 to 40,000 surplus young males every year worth from one to two million dollars annually. This shows how rapidly a once dwindling resource can be restored under proper international agreement.

In the southern Pacific and the Antarctic are remnants of more than a score of fur-seal herds which have long been commercially extinct, but which can be restored to vast commercial importance as has the Alaska fur-seal herd.

THE DESTRUCTION OF WILD ANIMALS

THE struggle of man with nature and civilization's consequent advance is wiping out many small and microscopic plants and animals just as it has meant death to the buffalo, the carrier pigeon, the fringed gentian, the moccasin flower and dozens of other animals and plants.

As the result of a survey, Dr. Henry B. Ward, of the University of Illinois, has found that the destructive activities of man affect the minute organisms which form the fundamental food supply of larger forms.

"In connection with the extensive and in part unavoidable destruction of breeding and feeding grounds to provide for the improvement of the land and the maintenance of a larger population," said Dr. Ward, "is added a little appreciated but exceedingly pernicious influence. Aquatic organisms of all sorts are affected by the extensive pollution of streams and lakes by city sewage and manufacturing wastes. Once that the public is educated to a comprehension of these unnecessary losses, it will insist upon the proper care of such wastes at the source."

The irrepressible conflict of a growing civilization with a rich fauna shows many changes that were unavoidable and includes also much wanton destruction of valuable natural resources.

The early records of pioneers and explorers portray vividly the marvelous richness of the North American fauna. Multitudes of wild mammals on the land, birds in the air and fish in the water furnished a varied food supply for settlers that did not disappear in many regions until fifty years ago. The total extermination of some species and the impending destruction of many others

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forces consideration of the proper methods for the conservation of our biological resources.

The magnitude of the interests involved is demonstrated by the present-day value. The game is almost gone. The fisheries, already greatly depleted in many regions, are threatened with early destruction in the absence of better control. Legal measures to limit the destruction of wild animals deserve more careful consideration and more strenuous enforcement. Such measures should be based upon adequate knowledge of the life history and breeding conditions favorable to the species. Maintenance of government hatcheries constitutes a partially effective correction for the heavy tax laid upon native fishes by commercial fisheries.

Our national parks serve the purpose of preserving in native purity unique examples of the American wilderness. As national museums, they will exhibit to posterity native wild animals under primitive conditions. Their preservation from the encroachments of commercialism is a debt we owe to future generations, and deserves the unqualified support of all true Americans.

THE EARTHQUAKE OF JULY 7

THE severe earthquake recorded by seismographs in various parts of the world on Tuesday morning, July 7, at about 9: 15 A. M., eastern standard time, was under the Pacific Ocean, about a hundred miles west of the southern tip of Lower California. This announcement was made by Commander N. H. Heck, chief of the Division of Terrestrial Magnetism of the U. S. Coast and Geodetic Survey, and in charge of the survey's earthquake investigations. Determination of the position was made possible by reports sent to Science Service from seismograph stations at Georgetown University, Washington, the Dominion Observatory at Ottawa, Canada, and the Coast and Geodetic Survey's station at Tucson, Ariz.

Commander Heck stated that there was close agreement between the three reports, so that he placed the epicenter, or the point of maximum violence, of the quake at longitude 112 degrees West and latitude 22½ degrees North. The vertical tremors seem to have been most marked. Probably there is no connection between this tremor and the Santa Barbara quake. The charts of the ocean bottom, made from soundings by the survey, indicate that there is a deep narrow trough at this point parallel to the coast. It is at such places that submarine earthquakes usually occur.

PLANETS IN JULY

THE five "naked eye" planets, Mercury, Venus, Mars, Jupiter and Saturn, in the sky at one time is the stellar feature of the July program on the celestial stage. They will be best seen towards the end of the month. Then, on the twenty-eighth, Mercury will be at the greatest distance from the sun, when it is best seen from the earth, and for a few days before and after it will be low in the western sky just after sunset.

Mars is getting into a poor position. It can now be seen in the western sky in the evening, in the constellation of the Lion, but at the end of the month it will set at 7:30 P. M. Venus is becoming more prominent. It occupies a conspicuous place in the western evening sky, and its brilliancy distinguishes it from the others.

Jupiter was at opposition with the sun on the tenth when it was visible all night. On account of its brilliancy, it could be seen while still very near the horizon, and then it has a distinctly red appearance. This is due to the great amount of the earth's atmosphere that its light has to pass through. If you look at Jupiter through a small telescope the moons are readily apparent. Galileo, who discovered them, used a telescope which was optically inferior to a good pair of opera glasses, and even with binoculars their daily motion around the planet may be observed.

Saturn, finally, is directly south about eight o'clock, and appears to the naked eye like a bright star. The ring system, which sets this planet in a class by itself, is now opening out. A few years ago we were right in their plane and could therefore see them edgewise only. To see these rings, a telescope magnifying at least thirty diameters is necessary.

THE ELECTRIC NEEDLE IN SURGERY

DELICATE electric needles that part the tissues before they actually touch them and render surgery less painful and dangerous are to replace in large measure the gleaming array of scalpels and other sharp instruments that have always been thought of as the badges of the surgeon's profession. This is the prophecy of Dr. Howard A. Kelley, one of the leading surgeons of Baltimore and for many years prominent in Johns Hopkins medical circles.

Dr. Kelley has developed his instruments and technique to the point where, in his own practice, he has already relegated the scalpel to a secondary place, using the needles for almost all his more important work. Among the advantages he claims for the new method are that it causes less pain and less bleeding, necessitates less handling of the body tissues with the fingers, and is followed by more rapid healing. The path of the needle through the flesh is self-sterilized, he states, so that there is less danger of operative infection.

Dr. Kelley cautions, however, against over-confident use of the new method by inexperienced persons. "These methods are not to be learned completely in a week or a year," he says. "They call for careful attention to a new technique, for discriminating judgment in their application and for increasing boldness with a growing experience. The concept is a new one."

TREATMENT OF LUPUS

AN electrified mixture of pulverized microbes and iron filings for the cure of exterior tuberculosis, such as lupus, tuberculosis adenitis and the like, was presented to the Paris Academy of Science, June 22, by Professor Charles Richet. The process is the invention of Dr. Arthur Grimberg, and has been tested on over 250 patients. It consists essentially of a colloidal extract of the Koch bacillus, injected under the skin of the sufferer.

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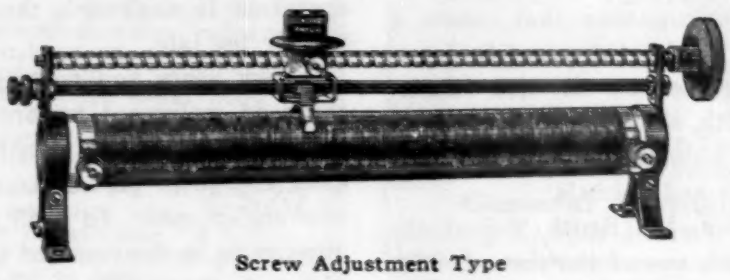

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SCIENCE NEWS

Science Service, Washington, D. C.

THE ORGANISM CAUSING CANCER

THE success of the British scientists in cultivating, observing and photographing the organism that causes a malignant cancer in chickens is of great scientific interest, but it will not help any one now ill with cancer, according to Dr. Erwin F. Smith, senior plant pathologist of the U. S. Bureau of Plant Industry, and an authority on cancerous growths in plants and animals.

In a recent visit to London, Dr. Smith visited the laboratory of Dr. J. E. Bernard, one of the three British scientists whose work is creating so much interest. There he saw tubes of clear serum containing the invisible infectious organism. Then he observed the living organism dancing about in a drop of serum under a specially constructed microscope, and also photomicrographs of this germ that is so small that it can not be seen under the highest powers of any ordinary microscope and that will pass through the pores of filters which will not let through the smallest known bacteria.

But this organism which causes a malignant tumor in chickens is related only very indirectly to human cancer, according to Dr. Smith. Dr. Peyton Rous, of the Rockefeller Institute, who discovered and studied this chicken tumor in the United States, determined beyond question its malignancy, and also that it could be produced in chickens in the absence of any tumor cells. He took portions of the malignant tumor and killed the cells in various ways: by grinding, by freezing, by drying for months, and with these dead cells he could still produce tumors when they were introduced into susceptible chickens. He found also that the cause of the disease is a filter passer, that it is so small that it will pass through the pores of medium Berkefeld filters which will not let through the smallest known bacteria. Nevertheless, this clear filtrate would produce the disease. Thus, once for all, he settled the question that the cause of cancer may be something separable and independent of the tumor cell, a matter which had been denied for all cancers by many research workers who said that the tumor cell is the only parasite. Dr. Rous was never able to isolate, cultivate or see the cause of this tumor in spite of prolonged and diligent search.

What Dr. Gye and his colleague, Dr. Bernard, have done is to cultivate this organism through a whole series of tubes, to see it under especially constructed microscopes quite different from the microscopes in ordinary use, and to photograph it.

The organism is a very peculiar body unlike any ordinary bacteria and it seems to me problematic where it belongs in the natural classification of organisms. It is like the pleuro-pneumonia germ.

As to the general bearing of this discovery on the whole subject of cancer, Dr. Smith points out that nothing is yet known as to the cause of human cancer aside from the fact that very frequently, if not always, it appears in irritated places; and if on its first appearance it is removed by the surgeon, it may never return, whereas if operation is neglected, the help of the surgeon comes usually too late.

A few years ago nothing also was known as to the cause of malignant tumors in the lower animals. But now we know of three tumors of the lower animals closely associated with parasites. One is a chicken tumor and two are in rats. In both of these rat tumors a worm appears to be the cause of the disease. Rats may be 100 per cent. susceptible to either tumor and no tumor results unless the worms are fed to the rats.

There are other experimental cancers apparently due to the application of certain chemical substances to the surface of animals. These are due to tar, arsenic, aniline and similar substances. Such cancers occur naturally in man and have been produced repeatedly in recent years in experimental animals. Only a portion of the animals become cancerous, although all are irritated by the applications, and not the whole irritated area in every animal becomes cancerous, but only tiny portions of it here and there. The question is raised whether the irritation is the direct cause, or whether it only paves the way for an organism.

It is possible to conceive that some stimulus might so disarrange the chromosomes or other substances in certain cells so that all their descendants would be abnormal and destructive to other portions of the body. This is one hypothesis. The other is that a parasite must be closely associated with the tumor in all its forms and stages, otherwise the growth would come again under the physiological control of the body.

THE TUBERCULIN TEST

THE forcible ejection of Dr. Clark H. Hays, chief of the state bureau of animal industry, from the farm of John Burke, of Elkhorn, Nebraska, on June 30, has resulted in contributions from farmers all over the state toward a fund to test their rights under the Nebraska law for the eradication of tuberculosis in livestock. Burke, according to Dr. Hays, refused to allow his stock to be subjected to the tuberculosis test in accordance with state law.

This test consists of injecting an extract of dead tubercle bacilli under the skin of the cow. Fever, swelling and inflammation at the point of injection constitute a positive test. Cattle with a positive test are condemned and killed.

The slaughter of thousands of cattle each year under the Nebraska law and similar laws in other states seems to be the basis of the farmers' rebellion. Their complaints that many of the cows which are slaughtered following a positive reaction to the test are found to be without traces of tuberculosis are in line with a series of investigations by Professor E. G. Hastings and Dr. B.

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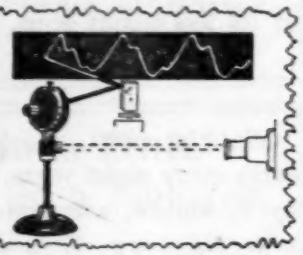

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A. Beach, professors of bacteriology and veterinary science at the University of Wisconsin. They reported to the Society of American Bacteriologists at their December, 1924, meeting that in twenty Wisconsin counties in three years, 387,180 cattle were tested, and 5,888 of these gave a positive reaction. Yet, on *post mortem* examination no evidence of tuberculosis could be found in 1,279 of the positive cases. In some of these latter they found a germ very similar to the one which causes tuberculosis, except that it was apparently harmless. Professor Hastings and Dr. Beach believe that this germ causes cattle to react positively and is the reason for many of them being needlessly slaughtered.

"Without the aid of tuberculin it would be absolutely impossible to attempt to control tuberculosis in livestock," said Dr. J. A. Kiernan, chief of the tuberculosis eradication division of the U. S. Bureau of Animal Industry, when he was asked whether the accuracy of this method of testing is in doubt. "Before use of tuberculin became general," Dr. Kiernan stated, "physical examination of cattle was depended upon, but it proved futile in freeing herds of the disease.

"The same percentage of accuracy is shown by tests now as was found more than thirty years ago when tuberculin was first used for the purpose of diagnosing tuberculosis in cattle," he continued. "Of more than 20,000 animals that reacted to the tuberculin test during June, 1925, 92 per cent. showed positive lesions of tuberculosis on the ordinary *post mortem* examination. Many more of those animals would have shown lesions had a more thorough search been made. Furthermore, laboratory examinations of the tissues of the animals that showed no lesions would reveal at least one fifth of them to be tuberculous. In some of the states where thousands of reacting animals are slaughtered, cases showing no lesions are less than three per cent., thus indicating a very high degree of accuracy for the test."

Dr. Kiernan pointed out that the campaign for eradication of tuberculosis in live stock is going on in every state, and that it is purely voluntary work, carried on under state laws and regulations. No owner is required to submit his herd to the test except in areas where at least 75 per cent. of the other cattle owners have their herds tested. During the fiscal year 1925, 7,000,000 cattle were tuberculin-tested in the United States.

A NEW DEWBERRY

A DEWBERRY that is larger and more resistant to disease than the ordinary berry now grown in gardens has been rediscovered and made available to the public through the efforts of horticulturists of the U. S. Department of Agriculture. This is the Young dewberry, a new hybrid variety which is wine-colored, somewhat darker than the Loganberry, but much sweeter than this favorite of the Pacific coast region. The new berry is suited for culture south of the Mason and Dixon line and west to Texas and Arkansas and it should prove specially satisfactory in the South.

This new fruit owes its origin to B. M. Young, an electrical engineer, who lives in Louisiana. As a hobby he indulged in plant breeding and produced the superior Young dewberry by a hand cross between the Phenomenal and Mayes varieties. The new berry was thus created in 1905. It was not destined to take its place in the world at once, for Mr. Young was so busy in following his profession that his creation was nearly lost when the original plants were destroyed. However, he gave some plants to a friend who moved to Pennsylvania. This friend sent some to the U. S. Department of Agriculture and to a sister living in Alabama and it was in her garden and in the department's grounds that the superior fruit was rediscovered only two years ago. So important did the government officials consider the size and disease-resistant properties of the berry, that they sent George M. Darrow, horticultural expert, to examine all plantings of it. Sufficient stock of the new fruit has been propagated to release the new variety to the public through nurseries. It is believed that there is a possibility that the Young dewberry may even replace the Loganberry on the Pacific coast.

Dewberries and blackberries are very similar fruits and are practically the same botanically. The dewberry is a trailing blackberry, unable to stand erect because of its less woody stem.

ITEMS

WOLF'S comet, which visits the neighborhood of the earth every eight years, was sighted on Monday, July 13, by J. Stobbe, astronomer at the Bergedorf Observatory near Hamburg, Germany. This information has been received by cable from the international bureau at Copenhagen, Dr. Harlow Shapley, director of the Harvard College Observatory, announced recently. When observed, the comet was in the constellation of Pegasus, just west of the "Great Square," in right ascension 22 hours, 58 minutes and 12 seconds, and declination 24 degrees, 16 seconds north of the equator. It is slowly moving towards the southwest. It will become brighter as it gets closer to the earth, but it is doubtful whether it will become bright enough to be visible to the unaided eye, even in the fall when it reaches perihelion and comes nearest the sun. Previously it approached within 149,000,000 miles of the earth. Since its last visit, however, it passed near Jupiter and was moved out of its former orbit by the great gravitational attraction of that planet, and now it will not come as close.

THE Temple-Swift comet is still far away from the earth, and the object sighted on June 28 by M. Delporte, a European astronomer, and supposed to be the comet, is in reality a tiny planet, Amphitrite, which has been known to astronomers for many years. This statement has been made by Dr. Edwin B. Frost, director of the Yerkes Observatory, as a result of photographs made of the object by Dr. George Van Biesbroeck of the observatory staff. "Delporte probably photographed the moving object while searching for the Temple-Swift comet," said Dr. Frost. "Later computations which we have received from England, however, indicate that perturbations by Jupiter will delay the return of that comet until next year."

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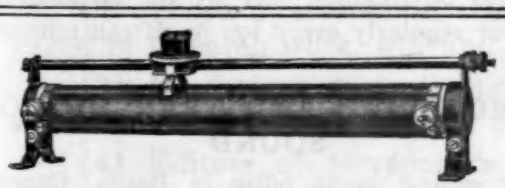

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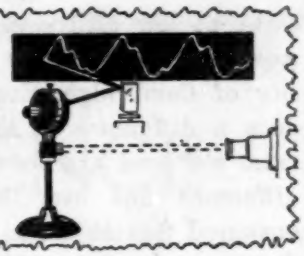

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SCIENCE NEWS

Science Service, Washington, D. C.

THE RELATIVITY THEORY AND THE ETHER DRIFT

THE Einstein theory of relativity must fall or at least require radical modification, if the experiments performed at Mt. Wilson, in California, by Professor Dayton C. Miller, of the Case School of Applied Science, are correct, is the opinion of Professor Albert Einstein himself, expressed in a communication from him to *Science Service.*

"If Dr. Miller's results should be confirmed," he says, "then the special relativity theory, and with the general theory in its present form, falls. Experiment is the supreme judge. Only the equivalence of inertia and weight remain, which would lead to an essentially different theory."

The Mt. Wilson experiments were intended to show the motion of the earth through the ether in space by which light and other radiations are supposed to be transmitted. When originally performed by Professor A. A. Michelson, now at the University of Chicago, and when repeated by Professor Miller at Cleveland, no appreciable result was obtained. When Professor Miller repeated it at Mt. Wilson, which is about a mile high, he obtained a marked effect, which seems to vary with the altitude.

According to Dr. Ludwik Silberstein, of the Eastman Kodak Company's Research Laboratory at Rochester, this indicated that the ether was dragged around by the earth at low altitudes, but drifted by at higher ones. According to Professor A. S. Eddington, of the University of Cambridge, England, such an effect would produce a difference in the position of stars as observed from sea level and mountain observatories, and no such difference has ever been observed. Dr. Silberstein answered this objection by the statement that the ether undergoes a peculiar kind of deformation, but Professor Einstein does not agree with him. He says:

"I can not share Dr. Silberstein's conception in case the experiments are correct. He means that with a theory of a deformible but fixed ether the known phenomena can be explained. This, however, is not so. A theory such as that is absolutely inconsistent with the positively proved astronomical aberrations. No theory exists outside of the theory of relativity and the similar Lorentz theory which, except for the Miller experiment, explains all the known phenomena up to date. Under these circumstances nothing remains but to await more complete publication of Miller's results. Then it is to be hoped that a correct decision will develop."

RADIOACTIVITY AND EARTHQUAKES

THE recent severe earthquakes felt in California and Montana and the mountain slide in Wyoming have aroused interest in the theory of Professor J. Joly, English geologist, on radioactivity as the possible cause of quakes. It is a well-known fact that throughout the entire earth's crust minute quantities of radioactive elements exist, mainly thorium and uranium, which are constantly producing heat by breaking down at a rate quite independent of the pressure and temperature found in the outer parts of the earth. The granites which are in the outer layer of the earth's crust contain approximately three times as much of these radioactive elements as the basaltic layer which is deeper, and this latter is twice as rich as the denser and more basic layer of peridotites.

Continents are essentially composed of granite embedded in a sub-stratum of basaltic composition. This has a lower melting point than the granite, and increases in volume about ten per cent. at its melting temperature. And since the basaltic layer is self-heating due to its radioactivity, Professor Joly states that it lacks only the latent heat of fusion to become fluid, and further, that at the present rate of disintegration it must again become fluid in about thirty million years. When this expansion has reached its greatest point the surface crust is correspondingly raised and increased in area about 650,000 square miles. The surface tension becomes so great that continents and ocean floors are split apart. Tidal action starts a slow westerly drift of the still solid continents and the superheated sub-stratum which originally lay beneath a continent now comes to lie beneath the ocean floor which melts away from below until the increasingly rapid loss of heat from the ocean checks and finally ends the process.

The reverse action now begins. Crystallization in the liquid basaltic layer takes place, the vastly increased land area contracts and settles down into the solidifying substratum and the margins of the continents especially are marked by intense compression, producing immense depressions and upheavals. This in brief is the cycle whereby the excessive heat due to radioactivity is accumulated and lost, during which succeeding cycles the ancient Eurasian ranges and the fairly recent Himalayas and Pacific ranges have been thrown up during the different geologic epochs. That such a cycle is nearing completion in the Pacific region is known, due to current observations on the steady sinking of the ocean floor and the regularity of the temblors, most of which are so slight as to be recorded only by the seismograph, but which occur regularly every ten or fifteen minutes.

THE RECORDING AND TRANSMISSION OF SOUND

A MAN sitting in an office in Berlin, Capetown or Pekin may soon be able to dictate a letter which will be heard and taken down instantly by a stenographer in an office in New York.

This is one of the startling results of an invention perfected in the laboratory of the Berlin Telegraphie Gesellschaft, Ltd., after secret experiments based on the researches of the Danish inventor Waldemar Poulsen. Briefly stated, the invention consists of a means of re-

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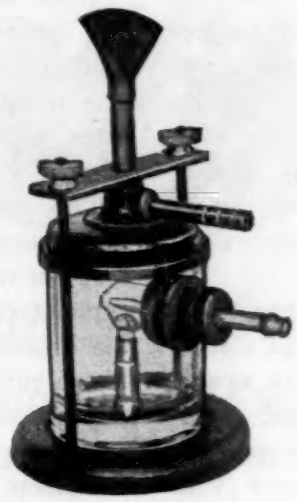

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cording and storing sounds on steel. The inventor, Dr. Kurt Stille, has been eighteen years at work on this question.

The sounds are recorded on a steel wire by electro-magnetic means, so that the wire bears no surface markings of any kind and can at will be "emptied" of its sound contents in readiness to receive others. The wire, which can be of any length desired, so that it may "take" the longest speeches or musical scores, can be connected with any telegraphic cable, which conveys the sounds further.

It is predicted that within a short time every newspaper correspondent in the world will be able to dictate his articles direct to his office. New music or operas or plays or statesmen's speeches will be heard simultaneously in all parts of the world without the rasping, noisy interference which at present interferes with purity of sound by wireless transmission.

One of the incidental effects, it is said, will be to drive the phonograph out of business. Even in the most perfect phonograph models, there is always a faint scratching sound as the needle travels over the vulcanite plate, which is completely eliminated by this new process.

In the machine turned out by Dr. Stille, the very thin steel wire revolves on two spools, deriving its current from a small electro-magneto; the sounds are conveyed by variations of the current. Pressing a button which induces another current "empties" the wire of its sound contents, which otherwise may be repeated at will and endure indefinitely.

The inventor describes the root principle of the invention in the following words: "We will suppose you want to dictate a letter. The sounds you utter are conveyed by means of a microphone and send waves through an electric current. This current flows through a small electro-magneto. The magnetic force becomes alternately weakened or strengthened according to what one might call the 'rhythm' of the electric current, which is of course based on the sound vibrations caused by the voice. This rhythmical magnetized electric current is communicated to the steel wire as it gradually winds out of one spool onto the other. When you cease speaking your words are recorded in invisible magnetic writing on the wire. To empty the wire of this writing is a very simple matter; one simply reverses the process and retransforms the magnetic waves into ordinary sound-waves."

Instead of being "emptied" for further use, the charged wire may be disconnected and stored up, when it will, on being reconnected, repeat its sound contents as often as is desired. The life of such a sound wire, unlike that of a phonograph plate, is limitless.

EXPERIMENTS ON A CURE FOR SYPHILIS

WHAT may be a sensational new cure for syphilis was unfolded before the French Academy of Sciences by Dr. Roux, the director of the Pasteur Institute, when he related the experiments conducted by M. Lavatte, one of his assistants at the institute.

M. Lavatte has discovered a new chemical substance which he calls acetylozyamynaphenylynate; it is composed in part of arsenic and bismuth, in the respective percentages of 15 and 45.

When injected into the muscles of infected rabbits, this proved to have astonishing curative properties, small injections resulting in the symptoms of the disease disappearing within forty-eight hours, apart from sores, which took from four to five days to heal completely.

Two medical men, Drs. Fournier and Schwartz, tried this treatment on human patients. They selected thirty cases, in varying stages of the disease, which they treated with intramuscular injections of two cubic centimeters of the substance with the twenty-five-letter name.

One curious feature observed was the utter absence of any discomfort, of any painful reactions during the whole course of twelve of these injections. The therapeutic effects were startling, the main symptoms disappearing within a few hours after the first injection and the sore healing with great rapidity. The Bordet-Wassermann test, on being applied at the end of the series to each subject, gave in every single case a negative reaction.

Dr. Roux added the remarkable fact that in every case, the treatment appeared to have a tonic effect on the general health of the patients.

THE EARLIEST INHABITANTS OF AMERICA

ASIATICS in their long trek to the Americas reached Oregon during the ice age at least twenty-five thousand years ago, according to Dr. Edwin T. Hodge, professor of geology at the University of Oregon. These early migrants found the climate of that time equally hospitable and perhaps even more pleasant that that of the present time. The glaciers which occupied the crest of the Cascade Range were not due to low temperature, to change in direction of wind, nor to increased moisture content of the winds which then blew. These glaciers were due to mountains which then stood one thousand feet or more higher than they do now and as a result they robbed from the moist, warm westerly winds their moisture and their warmth.

The early presence of primitive explorers in Oregon during this period of warm, humid climate is shown by the discovery of fossils of a race of men who were antecedent to the Indians which the white man found here thousands of years later. These early men lived in the Willamette Valley in a "happy hunting ground" where mammoth, mastodon, giant sloth, camel and horse gave abundant animal food, where the river waters were stocked with fish, and where they roved among the sequoia, walnut, oak and willow forests.

Previous studies of the Pleistocene, or Ice Age, of British Columbia, Washington and Oregon have brought out two statements regarding the climate of that time.

They state that "the temperature gradually grew colder and finally culminated in the development of glaciers" and that a great sound occupying the Willamette Valley was developed at the close. This latter statement, if true, would likewise indicate a colder climate. The presence of a large body of water, in contrast to an equivalent land surface, reflects most of the light

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15037 **RUBBER TUBING.** Black, pure gum; heavy wall; of same quality as No. 15032 above, but with greater wall thickness.

Diameter, inside, inches	1/8	5/32	3/16	1/4	5/16	3/8	1/2	5/8
Wall thickness, inches	1/16	1/16	3/32	3/32	3/32	3/32	1/8	1/8
Per Foot	.08	.08	.10	.13	.16	.20	.30	.36

15042 **RUBBER TUBING.** Red; light wall. This is a seamless, hand-made tubing that will not harden or tear. It is of a high degree of purity with Sp. Gr. of 1.10, is steam-cured, and being wrapped on steel mandrels, the diameter is smooth and uniform.

Diameter, inside, inches	1/8	5/32	3/16	1/4	5/16	3/8
Wall thickness, inches	3/32	1/32	3/64	1/16	5/64	5/64
Per Foot	.09	.10	.12	.10	.12	.15

15047 **RUBBER TUBING.** Red; heavy wall; of same quality as No. 15042 above, but with greater wall thickness.

Diameter, inside, inches	1/8	5/32	3/16	1/4	5/16	3/8	1/2	5/8
Wall thickness, inches	1/16	1/16	5/64	3/32	3/32	7/64	1/8	1/8
Per Foot	.12	.13	.14	.12	.15	.22	.28	.32

15052 **RUBBER TUBING.** White; light wall. This is a hand-wrapped, cloth-impression tubing, especially made for laboratory work. It is very flexible and will not split, and, being air-tight, it is suitable for use with gas or liquids, making it an excellent tubing for general laboratory work. Original lengths, 50 feet.

Diameter, inside, inches	1/8	5/32	3/16	1/4	5/16	3/8
Wall thickness, inches	3/64	3/64	3/64	1/16	1/16	5/64
Per Foot	.12	.13	.09	.07	.08	.12

15057 **RUBBER TUBING.** White; heavy wall; of same quality as No. 15052 above, but with greater wall thickness.

Diameter, inside, inches	1/8	5/32	3/16	1/4	5/16	3/8	1/2	5/8
Wall thickness, inches	5/64	5/64	5/64	3/32	3/32	7/64	1/8	1/8
Per Foot	.15	.18	.13	.10	.13	.18	.24	.32

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energy received, its latent heat is high and evaporation from whatever cause results in cooling.

As a result of studies extended over the past eight years, Dr. Hodge has arrived at conclusions which materially differ from those hitherto published regarding geological events of the Pleistocene period of Oregon and Washington.

THE DISPOSITION OF THE AIRPLANE CHICAGO

THE fate of the most famous airplane in the history of aviation is before the War Department, and museum officials are eagerly and hopefully awaiting a decision. The plane is the *Chicago,* flagship of the 26,000 mile round the world flight of 1924. It represents one of the highest peaks of efficiency reached in aircraft construction, for it combined long distance endurance with the ability to withstand the heat of southern India and the bitter cold of the Arctic.

The *Chicago* is now stored away in the oblivion of a hangar at Dayton, Ohio, and the National Museum wrote to the War Department early last autumn requesting that it be transferred to the museum at Washington where it would be a part of the national collection of historic planes. A number of other museums have also asked for the plane. So far, the War Department has only announced that it favors exhibition of the *Chicago* in a prominent and fitting place.

The National Museum believes that it has a strong claim to the *Chicago* because by law the museum is the depository of scientific and technical apparatus no longer useful to the government. The museum now has one of the largest collections of historic aircraft in existence.

A national collection has been in progress for some time, and we now have thirty planes, almost all of which are original, says Paul E. Garber, assistant curator, in charge of aeronautics, at the National Museum. Among the historic planes on exhibition is the Alaskan flag plane of the squadron which in 1920 flew from New York to Nome and back, making the 9,000 miles in 112 hours flight time. One part of the trip which takes 30 days by dog team was made by plane in an hour and a half.

Another important plane in the government collection is the T2, which was remodeled by Anthony Fokker in Holland for long distance flight. When tested it broke all previous records for remaining in the air, and crossed the continent without stopping in 1923.

Mr. Garber points out that the importance of the early planes that made history has been fully realized only in the past few years but such exhibits are now in great demand by museums. The Hargrave ornithopter, a wing flapping machine of 1898, which flew 312 feet propelled by compressed air, is an example of these old historic planes and is now in the National Museum.

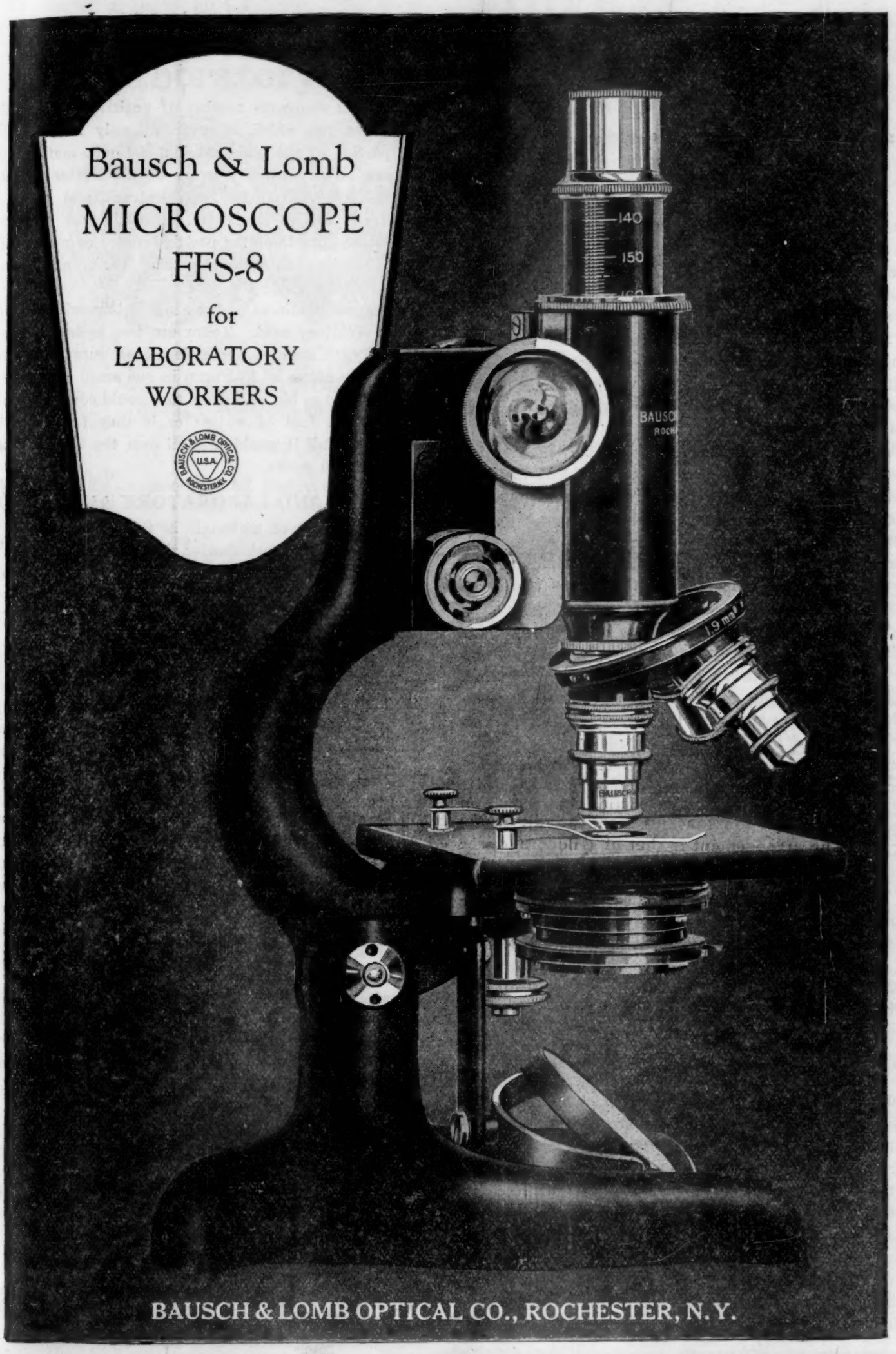
The famous NC4, the first plane to succeed in crossing the Atlantic, has been offered to the government, but it is so big that the museum has no place at present to exhibit it.

ITEMS

THE scientists who went to Dayton to aid the counsel for John T. Scopes in defending the freedom of teaching and the facts of evolution are sponsoring the raising of a scholarship fund that will enable Mr. Scopes to continue his education at some graduate school of his own choosing. "It is Mr. Scopes's desire to undertake graduate work in some branch of natural science," says a statement announcing the plans. "At present, however, he is without a teaching position or other means of obtaining the necessary money. Although he has been offered numerous lucrative lecture and stage engagements which would net him many thousands of dollars, he has refused them, wishing to avoid even the appearance of self-exploitation. Impressed with Mr. Scopes's intellectual qualities and modesty, and believing that he is entitled to some substantial recognition for the trying experiences that he has undergone in the service of science, and of liberty of thought and speech generally, the scientists who were associated with the defense have organized a committee to raise a scholarship fund of $5,000 to enable Mr. Scopes to undertake graduate work at an institution of higher learning of his own choosing during the next few years." Dr. Maynard M. Metcalf, of Oberlin College and the Johns Hopkins University, the first scientist to testify in Mr. Scopes's behalf, has consented to act as chairman of the scholarship fund committee; Dr. Kirtley F. Mather, of Harvard Geological Museum, Cambridge, Mass., is vice-chairman, and Watson Davis, managing editor of *Science Service,* Washington, D. C., will act as secretary-treasurer.

A NEW form of sun-dial that tells time to within thirty seconds on an ordinary clock face, has been received by F. Hope-Jones, chairman of the British Horological Institute, from the inventor, Dr. W. E. Cooke, government astronomer of Sydney, Australia, and is described by Mr. Hope-Jones in the magazine *Nature.* It consists of a ring which can move on pivots placed in a north and south plane, the position of the gnomon of the usual sun-dial. On one side of the ring is a small hole which, when the sun is shining, and the instrument is in use, casts a small spot of light on a figure-8-curve on the opposite side. This curve is marked with the date for various times of the year, and allows for the "equation of time" or the amount that the sun is ahead or behind its average position. To use it, the ring is turned until the spot of light is on the proper part of the curve, and the hands, which are geared to it, then indicate the correct time.

THERE is no getting away from bacteria for there are at least 30,001 on each kernel of fresh corn, 30,000 ordinary ones that are easily killed, and one "thermophile," or heat resisting organism not afraid to boil, according to experiments conducted in a canning plant for the U. S. Bureau of Chemistry by Lawrence H. James, government bacteriologist. Fresh hand husked corn has at least four times as many bacteria on it as machine husked, and these increase about fifteen times when the corn is cut and passed through sifting screens. However, after the corn was packed in brine and preheated to 185 degrees in the sterilization process, only one per cent. of the ordinary bacteria remained alive and ten per cent. of the more stubborn ones.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SCIENCE NEWS

Science Service, Washington, D. C.

THE COMPOSITION OF MATTER

DECLARING that the most solid matter on earth is made up of openwork filigree atoms composed of nothing more firm than charges of electricity and spread out so thinly that they resemble more nearly the starry heavens where thousands of light years separate the stars, Dr. Willis R. Whitney, of the General Electric Company, reviewed some of the modern disclosures on the make-up of matter before the American Chemical Society meeting at Los Angeles recently.

"There is nothing more interesting than the continual change in fundamental theories regarding matter," Dr. Whitney said. "We still stand about where the metaphysician did when he questioned the independent existence of energy and matter."

The atom of the past generation was by definition indivisible. For many years it had been evident that the character of all chemical elements varied in a regular or periodic way with increasing atomic weight. Attempts at explanation were made by assuming that all the different elements were merely different multiples of the very simplest one, hydrogen. But this theory was never justified by its results because the atomic weights were not multiples of a whole number.

Sir Ernest Rutherford, the British physicist, showed that two lighter elements, hydrogen and helium, can be literally knocked out of some of the simpler elements while heavier elements such as uranium, radium and thorium give off of their own accord helium particles, electrons and electro-magnetic radiations. The indivisible atom of by-gone days had therefore to go, and give place to divisible atoms of complicated internal arrangements.

We have now reached a stage where the actual picture of the structure of the atom is more intricate than any earthly geometrical figure, and more perfect than any known celestial system. The laws of astronomy have been called into play, and the super-celestial orientations are needed to explain the complicated, but not bewildering, the novel, but not embarrassing, internals of the atoms.

The electron has now taken the place of the elemental atom of our fathers. We can not claim that ours is simpler than theirs. Theirs was harder to pierce, but ours is harder to understand. Roughly speaking, the atom of to-day is a positive electrical charge with the equivalent number of negative charges spaced in and around it.

Crookes called the electron the fourth state of matter, as it was neither solid, liquid nor gaseous. Matter is at least not merely dry and hard, nor yet soft and wet. It is electrotonic and even celestial, whatever that may mean, and the most we know about it is that it is almost entirely space. It is as empty as the sky. It is almost as empty as a perfect vacuum although it usually contains a lot of energy. Matter is like a vacuum in which there are an enormous number of positive and negative electric charges, which, however, fill only an incredibly small portion of the space attributed to the matter. We may now say that every gram of all matter contains 600,000,000,000,000,000,000,000 electrons and an equal amount of positive electricity. The lightest atom has one electron outside of the positive center or nucleus, the second heavier has two, the third three, and so on, throughout the whole list of elements.

The actual smallness of the atom is impossible to realize, Dr. Whitney said. There are two hydrogen atoms to one oxygen atom in one molecule of water, and there are so many atoms of hydrogen in one small drop that if the atom were as big as a drop, they could cover the whole world with a foot of water; or if they fell as in the heaviest rainfall it would rain all over the United States for nearly two weeks.

X-RAYS AND LABORATORY ANALYSES

RAPID analyses of materials in the laboratory by the use of X-rays in a much shorter time than required by the older chemical methods is promised by Professor Urbain, of the Minero-Chemical Laboratory at the Sorbonne. With the assistance of Eugene Delaunay, he has just completed a series of tests of the X-ray method.

The apparatus used is composed of an X-ray tube; a lead screen in which a small slot has been pierced; a "selector" or tantalum, as a filter for the rays; a stand to hold the piece to be studied and a detecter to measure the intensity of the radiation received—the intensity being indicated by the displacement of an illuminated spot.

The material to be analyzed is placed in the beam, and when it is in good condition, the spot of light remains stationary; but if a fault in the material appears, the electrometer registers promptly. By recognized laws of physics, the deviation is proportionate to the amount of the fault in the matter. By this method, the smallest faults can be detected.

For actual quantitative work, the movable holder for the material is replaced by a small basin. By using, for example, distilled water as a base, and placing this first in the basin to set the "zero starting point," other solutions containing salts can be analyzed by straight calculations. For more than one salt in solution, more than one wavelength can be used.

The great advantages of this would be first for the speed of analysis, and second that a constant watch and check can be kept on the material used in manufacturing. M. Delaunay, who did the actual work, also says that there is no risk of error, which greater accuracy should prove invaluable.

TESTS FOR AVIATORS

THAT more work needs to be done on tests to determine a man's fitness to become an aviator is shown by a

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report of work done by George Brammer, of the Laboratory of Psychology at Stanford University. A certain degree of steadiness in muscular control is assumed to be a necessary qualification for a man who would become an aviator. During the war a number of tests were developed which were calculated to determine the nerve and muscle coordination of the would-be flyer before he was finally accepted for training in the art of flying.

In order to determine the value of this factor of steadiness, tests were made upon men in the Air Service of the U. S. Army at Crissy Feld, San Francisco. There were eighteen men and officers in the test group with from 110 to 1,775 hours of actual flying to their credit. The same tests were given to eighteen students of the University of California who had qualified for the Air Service of the R. O. T. C., but none of whom had had any flying experience.

The test subject stood in a comfortable standing position and by means of an apparatus known as the ataxiameter the amount of body sway in one minute of time was recorded automatically. Tests were first made with the eyes open and then with the eyes closed.

Results showed that this steadiness test is not a reliable criterion of a man's ability to become a flyer. Some men who had a creditable flying record showed a poor score in the steadiness test. It was also found that with a little practice a man might make a good score in the test, but that men with flying experience did not make a better average score than those without any experience in flying.

AN INTERNATIONAL PSYCHOANALYTICAL FOUNDATION

THE establishment of an international psychoanalytical foundation to be headed by Professor Sigmund Freud would be highly desirable, is the opinion expressed by Dr. William A. White, well known psychopathologist and superintendent of St. Elizabeth's Hospital in Washington, D. C.

The foundation, which is planned by the followers of Professor Freud in New York City, would bring the activities of the Freudian analysts under a central organization. It would have charge of the maintenance of the present psychoanalytic clinics and educational institutions in Berlin and Vienna, and is expected to lead to the establishment of such institutions in the United States. The foundation would also publish psychoanalytic literature and conduct a publicity campaign to dispel misconceptions of the Freudian theory and to combat the activities of "fake" practitioners.

Dr. White suggests that inexpert analysis of dreams and mental states in this country has not been due so much to deliberate quackery as to the lack of opportunity for psychoanalytic training.

"I have not met with many analysts to whom the term 'quack' could be properly be applied," says Dr. White. "There are undoubtedly a good many people who are making analyses who have not been technically trained, but who are doing the best they can with such information as they have and such technique as they can develop. I am constantly being asked where one can get training in psychoanalysis and having to reply that there is no place in this country. There has never been any opportunity here for systematic instruction and the method can not be learned successfully by the average person from the literature.

"Because of this fact, and the added fact that physicians in the United States have been mainly out of personal touch with the Europeans, especially during the war, undoubtedly errors of technique are numerous, and of course among a large number of readers all sorts of misunderstandings exist. An international foundation would do much towards improving the understanding of psychoanalysis and towards offering opportunities for training—both very highly desirable aims."

ITEMS

HOT summers are shown by a Swedish geologist, Professor Gerard de Geer, of the University of Stockholm, to have occurred occasionally even in the glacial ages when all the northern continents, including the North American, were covered by a thick ice blanket. Such variations in temperature from one year to another are read by him in the many thousands of clay samples which he and his pupils have collected in different parts of the world, including the United States. By their differences in thickness and color the layers of clay show exactly how much ice was melted by the sun's heat during the year they were formed and thus record not only the earth's age, but also its past temperatures as clearly as the rings of a tree show by differences in thickness which seasons have been wet and which dry. Upon retiring from his professorship in the University of Stockholm, Baron de Geer has now been enabled, through the generosity of some of his Swedish friends, to found a separate institute in Stockholm as part of the university and devoted wholly to research work in his particular branch of geology, that of geo-chronology, or the study of the earth's age. He has been in the United States twice to collect clay specimens.

THE ether which is believed to pervade space and carry light may be compressible, according to the ideas of Dr. Ludwik Silberstein, of the Eastman Kodak Company's research laboratory. In a recent statement to Science Service, Professor Albert Einstein differed with Dr. Silberstein's views, saying that the Stokes theory of the ether, on which Dr. Silberstein's is based, would not explain the astronomical aberrations. It was, he said, based on a mistaken idea that the velocity of the ether movement was deducible from a potential. "Against Professor Einstein's contention," says Dr. Silberstein, "a velocity potential of the ether motion as required for the Stokes theory of aberration becomes possible at once if the ether is assumed to be compressible. This was originally suggested by Planck, and was adopted by H. A. Lorentz, who based on it a perfectly satisfactory theory of aberration. All other phenomena then known were also covered by this theory. Whether the new experimental findings by Professor Miller will necessitate a further modification remains to be seen."

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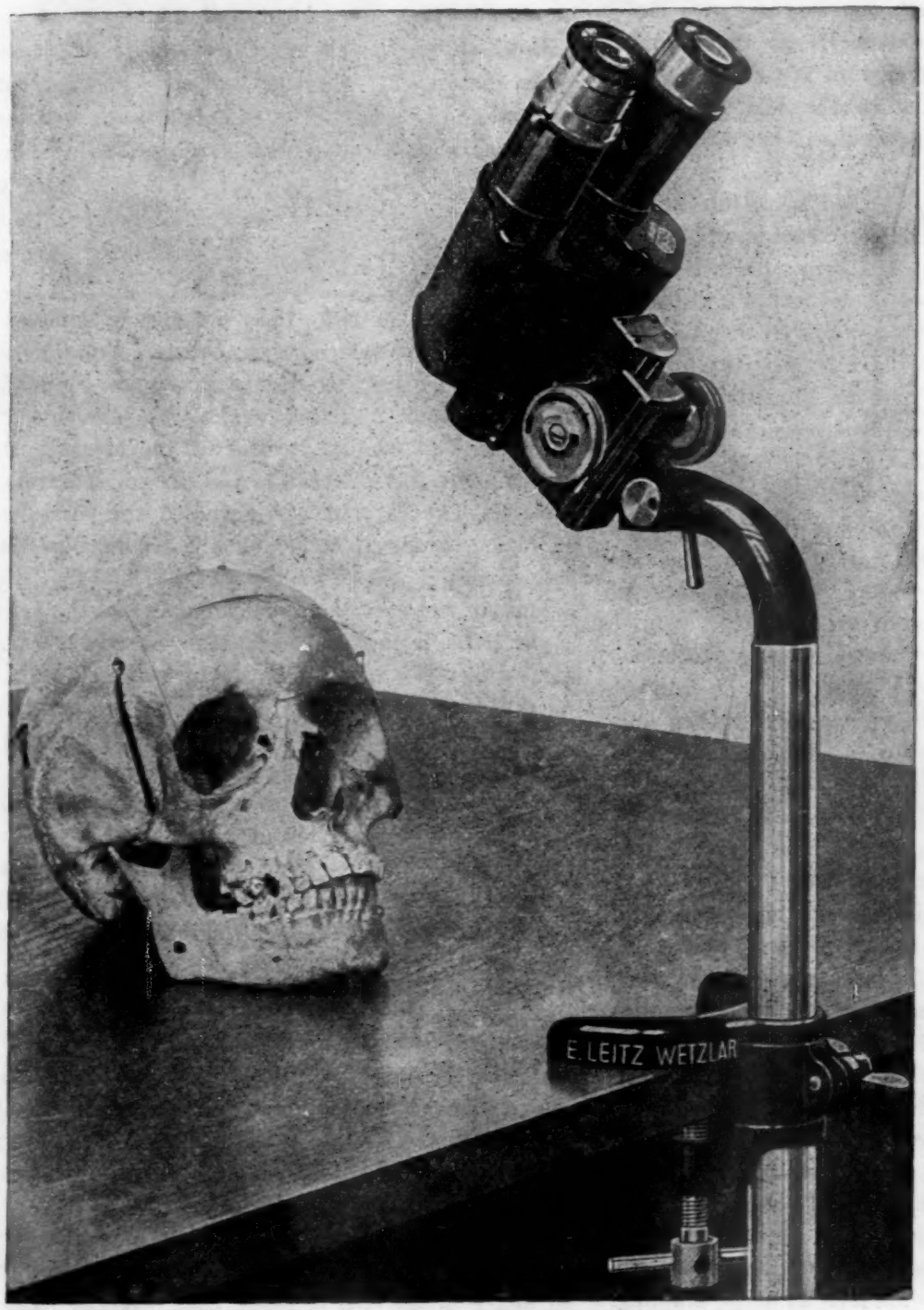

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SCIENCE NEWS

Science Service, Washington, D. C.

CHEMICAL WORK REPORTED AT LOS ANGELES

THE process of imprisoning nitrogen in solid compounds from air by means of the electric arc is made possible in the state of Washington through the use of cheap electrical power, according to Professor H. K. Benson and W. L. Beuschlein, of the University of Washington, who spoke before the meeting of the American Chemical Society at Los Angeles on August 4. Ninety-four per cent. of all the electrical power in Washington state comes from water power as compared with thirty-four per cent. for the entire United States. Municipally-owned plants in Tacoma and Seattle are connected with the highly developed privately-owned plants in other parts of the state and are organized to dispose of surplus and seasonal current. The only arc plant in America for fixing nitrogen is in Washington and has recently enlarged its capacity for supplying the American demand for sodium nitrite. The yield is about two ounces of nitric acid per kilowatt hour. The process consists of oxidizing the nitrogen in the air by means of powerful electric arcs, which is then absorbed by sodium hydroxide forming nearly pure sodium nitrite and water. When the water is evaporated, the nitrite is ready for shipment.

Another process for permanently connecting the nitrogen of the air with something solid on earth is that of splitting water by means of electricity into oxygen and hydrogen. Air, which is four fifths nitrogen, is then added to this mixture, the oxygen removed and the mixture purified. Then at the high pressure of 300 atmospheres, and at a low temperature, the mixture of hydrogen and nitrogen unite as ammonia, each nitrogen atom taking unto itself three little atoms of hydrogen, in the presence of a catalytic agent, a sort of chemical parson.

A thousand years' supply of potash for the American farmer, independence in the future from European supplies and the establishment of a new great industry in the United States are all possible as a result of a new process for making potassium sulphate from the great quantities of greensand found in New Jersey, Delaware and Maryland, according to a report to the American Chemical Society by Dr. J. W. Turrentine, C. W. Whittaker and E. J. Fox, soil chemists of the U. S. Bureau of Soils. The process has been made economically possible by the manufacture of valuable materials such as alum, alumina, ochers and glaucosil, a new earthy absorbent, as by-products. The new process is being demonstrated in the laboratories of the Electro Company at Odessa, Delaware. The method consists in extracting the raw material with sulphuric acid. The greensand deposits, which are practically at the surface, can be worked with steam shovels, and Dr. Turrentine said that they are ideally located with respect to water or rail transportation, labor supplies and markets.

That vitamin A, found in butter, cod liver oil and many other substances, may increase the span of life, was shown by experiments on rats, reported by J. A. Hansbrough, of the University of Florida. Rats that were fed on distilled water and white corn alone, which is known to be unsuitable for normal growth and health and lacking in vitamin A, amino acids, and a number of necessary mineral substances, lived only an average of 60 days. When the missing salts were added to the diet, rats lived an average of 68 days. When casein was added supplying the missing amino acids, rats survived 87 days, but when butter was added to the diet of plain white corn, the rats began to live on forever, at least as far as the experimenters have been able to determine, for they are still alive and healthy at the end of 223 days.

Examination of more than a thousand samples of distilled liquors on sale in Massachusetts showed that more than nine per cent. contained poisonous copper salts in varying amounts. These results were announced by Dr. Hermann C. Lythgoe, director of the Massachusetts Department of Public Health, and his collaborators, to the society. The experimenters studied the corrosive power of various kinds of fermented liquors distilled through a copper coil.

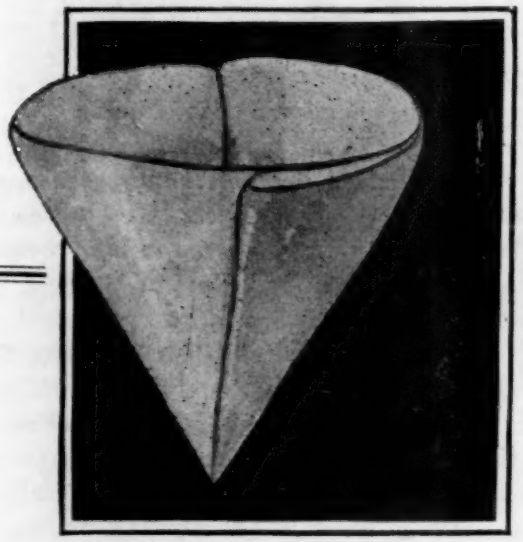
Making motor alcohol from molasses and the juice of the sugar palm is now only a matter of cost because technical difficulties in the manufacture as well as in the use of the fuel by standard automobile engines have been solved, according to J. P. Foster, chief chemist of the Maui Agricultural Company's sugar factory in Hawaii. The advantages of this new motor fuel are said to be easy starting, elimination of knocking and freedom from carbon troubles. The alcohol is denatured by the use of ammonia, pyridine or aniline which also neutralizes the acidity of the fuel and the substances left over after burning.

RESEARCH IN CANCER

A DEFINITE poisonous principle in cancers and tumors, long suspected, but until now undemonstrated, has been shown to exist, according to the claims of three German investigators, Drs. R. Syderhelm and W. Lampe, who worked together, and Dr. V. E. Merteus, who conducted his investigations independently.

Drs. Syderhelm and Lampe made alcoholic extracts of cancerous tissue, dissolved the precipitate they obtained in salt solution and injected mice with it. The extract proved to be very poisonous to the mice, but only when the operation of extraction was carried on at a comparatively low temperature. At ordinary room temperatures no result was obtained. They conclude that the poisonous principle is destroyed at ordinary temperatures by an autolytic enzyme or self-digestive ferment that comes out in the extract along with the toxin.

Dr. Merteus made an extract from tumorous tissue with weak alcoholic solution, and found that the white powder left behind upon evaporation was poisonous to mice and guinea pigs.



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Another German scientist, Dr. A. Werechinski, has obtained results that seem to confirm the view that cancerous and tumorous growths are similar to embryonic tissue, in that they are simply masses of rapidly growing cells; but that they have "run wild" and escaped from the controls of normal growth. Dr. Werechinski injected finely minced embryonic kidney and adrenal tissue under the skin of a guinea pig, which subsequently developed characteristic tumorous growths in two different parts of its body.

On the heels of the discovery of the antagonism between malaria and paresis which has made it possible to treat the latter disease by inoculating the patient with the former, comes a claim by a Russo-German physician, Dr. A. Braunstein, that he has discovered a similar antagonism between two other diseases, cancer and diabetes.

Recent researches in Germany have shown that cancer cells possess an abnormal appetite for sugar. One worker has shown that in thirteen hours a certain type of cancerous tissue can consume its own dry weight in sugar. Dr. Braunstein, who has been working on the problem for a dozen years, states that in his clinical experience he has noticed three outstanding facts regarding the mutual influence of diabetes and cancer. First, when a diabetic patient becomes afflicted with cancer the dangerous concentration of sugar in his blood and other body fluids falls off notably. Second, the patient becomes much more tolerant toward sugar and starch-containing foods. Finally, if the cancer is removed by surgical operation, the sugar content rises again.

One of the discoverers of the cancer germ, J. E. Barnard, F.R.S., will talk before the meetings of the British Association for the Advancement of Science to be held at Southampton from August 25 to September 2. Mr. Barnard's title is announced as "The observation of the infinitesimally small" and he will tell of his perfection of the ultra-violet microscope with which he assisted Dr. William E. Gye in seeing for the first time the minute organism or virus that is credited with causing cancer in chickens.

THE MECHANICS OF WALKING

FACTS and figures about leverage, stresses and distribution of weight in the human foot are to be sought by means of specially designed instruments at Yale University.

For several hundred thousand years men have been operating that remarkable mechanical device—the human foot—without knowing exactly how the thing worked or what to do when the mechanism failed. X-rays and studies of anatomy have helped to show the complex structure of the walking apparatus, but experts still differ in their interpretation of how the bones and muscles and tendons are coordinated.

Dr. Dudley J. Morton, instructor in surgery at Yale, who is in charge of the foot investigation, says that results of the army examinations during the recent war clearly show the practical value of the proposed research. The usual standard for determining the foot efficiency of the soldiers was the condition of the longitudinal arch.

"This method," he says, "led to the rejection of many applicants and drafted men whose feet presented low arches, but who had never experienced discomfort even under strenuous activity, because their body weight was properly distributed through their low-arched feet. On the other hand, many thousands of accepted recruits who possessed well-developed arches were soon assigned to 'development camps' because of foot trouble."

These facts testify to the unreliability of the height of the arch as a standard for determining the potential strength and integrity of the feet. The proficiency of the foot depends essentially upon the ratio of weight distribution to the chief bearing points of the feet.

Dr. Morton aims to estimate by mechanical means what the normal ratio of weight distribution is, that is, how the weight is distributed over the different sections of the foot, and how the ratio varies as the foot and other parts of the body change their position. He points out that he hopes "to devise, if possible, a practical method of foot examination which will eliminate the personal element on the part of the examiner and establish a uniform and accurate standard for foot examination both within the profession and for industrial and other purposes." The investigation is expected to provide a working ground for later study and progress in the treatment of foot disorders.

PSYCHOLOGICAL TESTS OF MOTORMEN

SPECIAL laboratory tests by which it may be possible to pick out the man who has the makings of a safe and efficient street-car pilot are being devised by Dr. Morris S. Viteles, of the University of Pennsylvania.

A man's rating on an intelligence test does not always indicate whether he is likely to lose his head in emergencies, or to run his car badly. This was shown by giving such tests to motormen in regular employment and comparing the results with the men's records in service and with the opinions of their supervisors.

Dr. Viteles then worked out a motorman selection test by which signals are given on a piece of mechanical apparatus and the prospective motorman responds with the same muscles that would be used in operating a trolley car. This apparatus measures the safety factors, such as a man's capacity to learn, his ability to keep his attention steadily on his job, and to act quickly in emergencies so as to avoid accidents. To test an applicant's general ability and courtesy, the psychologist devised a set of questions such as: "If an intoxicated man was annoying the passengers in your car would you: (1) Put him off the car? (2) Pay no attention to him? (3) Turn him over to the nearest officer? (4) Report to the train dispatcher?"

The problem of the alert and capable motorman is also being studied by use of elaborate testing machines in a new laboratory in Paris. A feature of the French laboratory is a realistic reproduction of a street car, in which the motorman's reaction speed and control are put to the test.

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of Chicago by Professor James H. Breasted for excavations on a large scale, to begin in the near future. Over four hundred workmen will be employed, in addition to the regular staff of scientific experts. Professors D. F. Higgins, of the University of Chicago, and C. S. Fisher, formerly of the University of Pennsylvania, expect to leave for Palestine about September 1 to make preliminary surveys of the ground and select suitable camp sites.

Armageddon, where, according to Scripture, the last of the world's great wars will be decided, is a mountain district, a continuation to the southward of the Carmel highland, lying in central Palestine, just across the great plain of Esdraelon from the holy city of Nazareth. The town of Megiddo, from which the region takes its name, commands a pass that leads to the plain of Sharon on the seacoast, and has therefore been the scene of much fighting in ancient times between the great kingdoms of the Euphrates Valley to the north and Egypt to the south, as well as the tribal battles of the Israelites with their neighbors. The part that Israel took in this fighting is recorded in two places in the Old Testament.

The first of these is in the song of Deborah and Barak, after the discomfiture of their enemies: "The kings came and fought, then fought the kings of Canaan in Taanach by the waters of Megiddo." (Judges 5: 19.) This triumph of the Israelitish champions (one of them a woman) over Sisera, leader of the army of their oppressors, is the record of a small and local war. In the second conflict recorded, Israel was an ally of Assyria against Egypt, and its king, Josiah, sacrificed his life at Armageddon in the effort to turn back the Egyptian invader: "In his days Pharaoh Nechoh, king of Egypt, went up against the king of Assyria to the river Euphrates; and king Josiah went against him; and he slew him at Megiddo, when he had seen him. And his servants carried him in a chariot dead from Megiddo, and brought him to Jerusalem, and buried him in his own sepulcher. And the people of the land took Jehoahaz, the son of Josiah, and anointed him and made him king in his father's stead." (II Kings, 23: 29, 30.)

With this long tradition of bloody fighting, it is not to be wondered at that the terrible apocalyptical visions of final battle, slaughter and dissolution at the end of the world should have been localized by the seer of revelation at Armageddon.

How old the town of Megiddo is, no one knows, but archeologists agree that it is older than history; or rather that the series of cities on the same site, one built over the ruins of the other, present such a long succession. It will be the purpose of the present expedition to gather data to illuminate this point, and with it to gain much new light on the ancient civilizations that met and battled there.

The expedition has selected, as the site of its first excavations, the scene of the most recent of the many battles of Armageddon: a ridge which lies about ten miles from the city of Nazareth, where the British, under General Allenby, met and defeated the Turks during the great war.

ITEMS

RECENTLY published statements claiming an appalling prevalence of disease among the Indians are declared by Dr. Hewett to be misleading. A recent survey shows that venereal disease is only about as common among the Indians as among their white neighbors, and if compared with the colored population of the South the Indians are much the cleaner race. While trachoma is considered by Dr. Hewett to be the most serious disease among the Indians, he declared statements that "thousands of Indians are going blind from trachoma" are exaggerations. Much trachoma, mostly in the curable stage, has been discovered among the Indians, and government physicians are now engaged in an active campaign to wipe it out.

The question of titles to Pueblo lands is being adjusted by a lands board established by the congress, Dr. Hewett said, in urging that appeals for money to bring in more lawyers should be ignored by those who have the interests of the Pueblos at heart.

"With the government's present Indian policy, liberal congressional appropriations and many friendly societies and individuals, the future of the Pueblo Indians is fairly well assured," Dr. Hewett declared. "There is, however, always danger of 'too much white man's medicine.' It is what he does for himself that makes for his future character and progress."

THE United States Bureau of Fisheries has answered the call of fishermen to do something about the irregular habits of the mackerel, one of the most highly-prized fish in American waters, and it is now initiating plans whereby the mystifying movements of this species can be traced. In some years the fishermen on the North Atlantic coast haul in many tons and in others there are hardly any of the fish. Certain localities that are known to be thickly populated by mackerel are suddenly deserted for years. The fish spoil an apparent regular and seasonal migration by bobbing up unexpectedly at both ends of their range at the same time or by appearing simultaneously at a number of places along the coast. O. E. Setto, assistant in charge of the Division of Fishery Industry, has been slated to determine the line of investigation and is now at Woods Hole, Mass, where a marine biological station is located.

VITAMIN "C" is present in concentrated orange juice as well as in fresh, according to the results of experiments by Dr. Harold Goss. The efficacy of the citrus fruits as antiscorbutic agents has long been recognized, for even before any one knew anything about vitamins British sailing ships earned the name "lime-juicers" by carrying quantities of lemons for the prevention of scurvy among the crew on their long voyages. In modern times, the question whether concentrated orange juice was as good as fresh for this purpose has developed considerable importance in the California orange belt. Dr. Goss's conclusions state that desiccated orange juice as well as concentrated juice possesses high antiscorbutic value, and that lemon juice ranks with orange juice in this respect.

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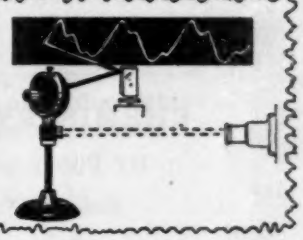

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CHEMISTRY AT LOS ANGELES

By Professor G. Ross Robertson

Science Service Correspondent

Pectin, the mysterious chemical that puts the "jell" in jelly, is the latest product credited to the homely lemon. American Chemical Society delegates were told at their annual convention at Los Angeles of processes by which the fruit is worked up almost as thoroughly as a hog in the Chicago stockyards.

Already enormous quantities of superfluous lemons, collected from the whole southwest when the market is dull, are now being converted into citric acid and lemon oil at Corona, Calif. Now comes the white rag of the peel with its contribution of a potent jelly-forming principle. This appears as a dry gray powder, ready to aid the housewife in compelling a rebellious fruit juice to jell.

Formal commercial standards were advocated by C. P. Wilson and associates. Hitherto pectin has been marketed in the form of a crude fruit extract carrying with it the original flavor of the fruit used in manufacture. Such pectin is attractive to the jelly-maker who wishes to prepare the same flavored jelly, but is ill adapted to a jelly of special delicate flavor other than that of pectin preparation. The new dry lemon pectin, running as high as 90 per cent. of the essential jelly principle, carries no confusing flavor. It requires no fruit juice to prepare a jelly from lemon pectin. Sugar, acid, water and pectin are the sole necessities. None of these four may be omitted, else the jelly will not jell, but flavors may be added at will.

Dr. W. H. Dore, pectin chemist, holds scant hope of artificial synthesis of the jelly principle, on account of the extraordinary complexity of its chemical make-up.

That scientists should keep out of the evolution controversy is the opinion of Dr. R. A. Millikan, world-famed physicist, and his statement has been endorsed by leading members of the American Chemical Society. Dr. Millikan's counsel given at the chemical conclave is by no means to be taken as a weakness of the scientists' position in the mooted issue of freedom of thought. Rather it is a clear-cut statement that the business of the scientists is to draw conclusions from facts. The confusion of speculation with scientific fact, Dr. Millikan said, is obscuring truth and creating needlessly a host of enemies of science.

Visiting chemists score the recent public indictments of the scientist in which he is accused of trying to undermine religion and promote atheism. College professors in science are in the business of collecting, organizing and teaching facts, and have no obligation to preach any brand of religion or philosophy any more than the specialist in plumbing or music. There is no disposition here to oppose the introduction of religious instruction in the schools, provided there can be a universal agreement on the plan. This is, however, not the job of the chemistry professor.

Following the concluding session the chemical society *en masse* ascended Mt. Wilson and viewed the heavens through the monster instruments of the solar observatory. In some ways the feature trip of the national meeting was the final excursion to Trona, Calif., where on the Mohave Desert is located the Verdun fortress of the American potash industry. After seven years' battle against terrific odds, only this one potash enterprise survives on American soil. According to Dr. R. W. Mumford, potash expert at the convention, Searles Lake at Trona, with a deposit of potash-bearing salts seventy-five feet thick and twelve square miles in area, could meet the demands of the whole United States even if the nation could be blockaded for a hundred years.

Warnings against chemical poisons in bootleg liquor were given.

Nearly 10 per cent. of the illicit distilled liquor captured in Massachusetts contains poisonous copper compounds, according to Miss Blanche D. Berry, Boston chemist. The liquor vapors attack the copper tubing used in moonshine operations and carry the material through into the finished product. It is presumed by chemists that acetic and butyric acids, caused by misdirected fermentation of impure mashes, form verdegris and like poisons from the copper. The local prohibition office reports similar trouble from lead in the solder used by illicit distillers in the construction of their apparatus. In extreme cases common pipe galvanized with zinc is employed, said to be giving rise to so-called "galvanic poisoning" which is being encountered by the police.

The industrial chemical laboratory may apply fundamental principles, but it is the poorly paid academic genius who is likely any day to upset a whole manufacturing industry by some unexpected discovery, Dr. James F. Norris, noted organic chemist of the Massachusetts Institute of Technology, said in his annual presidential address to the American Chemical Society.

The college professor can not ply his research in the industrial laboratory, according to Dr. Norris. He would be discharged in six months when the stockholders found he had not made an impression on the current dividends. There must be no commercial check on the performance of the university investigator. Criticizing the present-day American chemistry professor for his aloofness from industry, President Norris urged his fellow professionals at least to choose their problems from the domain of the practical world. Once chosen, the program of research must be left to unfold free and unfettered by ties to the dollar mark.

Any chemical on earth, continued Dr. Norris, if reduced sufficiently in price, will find a use in the every-day world. Hundreds of thousands of chemical substances now already known but still unused cost at present more than their weight in gold. This fascinating array of material lies open before the rising young chemist, ripe for some revolutionary application.

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President Norris ridiculed the idea that the mastery of coal tar and its wonderful drugs and dyes was an easier task than the mastery of petroleum, not yet accomplished. The petroleum companies must broaden their interest beyond the domain of gasoline and lubricants, and with large financial support penetrate the vast unknown of the chemistry of oil.

The intensely sweet sugar, levulose, will soon come to the rescue of glucose candy, Dr. Herman Spoehr, carbohydrate expert of the Carmel, Cal., laboratory of the Carnegie Institution, predicted. Sweetmeats made of glucose or common commercial corn syrup alone do not satisfy the American tooth, although they have the smooth texture so desirable in fancy modern confections. They simply are not sweet enough. Fortified with the new commercial levulose it is expected that glucose candy will move up into the saccharine aristocracy at the front sales counters. Other reports indicate that all clouds on the reputation of glucose have been removed by the latest purification of the product until it is now a 99.85 per cent. sugar of snowy crystalline beauty.

Dr. Leroy S. Weatherby, organic chemist of the University of Southern California, told the national convention how a new dahlia and artichoke industry promises new life for domestic sugar manufacturers. At present huge beet sugar plants are lying idle two thirds of the year for lack of raw material. It is now expected that after producing beet sugar in the summer, the plants will run four months on artichokes, followed by four months on dahlia tubers to produce large quantities of the new levulose sugar. At present levulose is prepared only as a syrup or moist powder-like brown sugar, but the problems of crystallization are rapidly being solved commercially.

The popular idea of levulose as a panacea for diabetes is seriously questioned by Dr. J. W. E. Glattfeld, research sugar expert of the University of Chicago. While the new sweetener is more rapidly digested and at first seems to be tolerated better than common sugar, the toleration soon ends when the diabetic internal organs start chemically converting levulose into glucose, the very material they can not endure. The only assured value of levulose in diabetes is in the possibility of sweetening the patients' food with only half the quantity of sugar customarily used when common cane sugar is on the table.

An explosive so violent that it drove the pieces of its container shot-hole fashion clear through a near-by bottle without cracking the bottle was described by Father J. A. Nieuwland.

The new substance is divinyl acetylene, product of remarkable new developments in acetylene chemistry at Notre Dame University. As usual, dyes and explosives are bed-fellows in this research, and a brilliant new scarlet color is one of the results of combining acetylene with coal-tar derivatives. This is the first serious and extensive use of acetylene in chemical synthesis, the gas having heretofore been relegated to the domain of the steel-welder.

If you feed on white corn bread alone and want to live long and happily, don't fail to lay the butter on thick. Experiments of J. H. Hansbrough and associates reported to the chemists show that a rat's life is sixty days on a white corn diet but just five per cent. addition of clear filtered butter fat adds at least five months to its life. Late bulletins show the butter-eaters still alive, happy and apparently still only middle aged. Vitamin A, the mysterious chemical disease-preventive of butter, seems here to be the key to longevity.

The question is still open whether vitamin A will add years to the life of a human being, although scientists are finding a remarkable correspondence between the internal life habits of man and the rodent.

Cod liver oil, the food which saved the war-cursed children of the Balkans from death by shortage of vitamin A, is not always a satisfactory source of the mysterious life-giving chemical, V. E. Nelson told the chemists. New methods of inspection and test are needed and not yet available for rejection of useless oil whose deceptive appearance gives no clue of its value.

Pseudo chemistry is a symptom of a new kind of mild insanity described by Dr. Frank C. Whitmore, new chemical chief in Northwestern University. This discussion is apropos of the new crop of cranks now pestering the officials of the American Chemical Society. Fantastic inventions, the "key to evolution," the "paracelsus two-force energy of the root of the atom" and similar jargon are regarded by Dr. Whitmore as a queer outgrowth of modern mass education in elementary science and the uncritical use of science libraries. As Mark Twain would say, the deluded devotee of science "knows the words but he doesn't know the tune." Such complete ignorance of the real working principles of science operates in peculiar ways. It is driving the real scientist into the apparent position of an intellectual snob. More strikingly it is misleading multitudes of people by discrediting the theory of evolution by the use of fancy scientific verbiage.

It is high time to stop stuffing mere chemical facts into the heads of college students, according to Dr. Joel H. Hildebrand, of the University of California, in a forceful challenge to the national assemblage of chemical educators here. There are over three hundred thousand different chemical compounds already known, and the new chemical discoveries in one year in the United States alone cover ten thousand printed pages of reports. It is utterly hopeless for the greatest chemical genius on earth to learn one per cent. of the known facts of chemistry.

Dr. Hildebrand's slogan is not what chemicals are like but how they work. Complete elimination of the cram system in college examinations is the immediate result of the new system of chemical education. For the student with a mind like a mere phonograph record the plan is, however, almost fatal unless he starts to do some thinking.

The life of the American synthetic drug industry depends on the coming decision of the United States Supreme Court in the German patent case. Dr. Arthur D. Hirschfelder, University of Minnesota pharmacologist, scored the political interests who have place the department of justice in the position of a pro-German litigant now seeking to rob American drug manufacturers of the

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patent rights on arsphenamin, novocaine and numerous priceless preparations vital to the work of the modern surgeon. After publishing deceptive recipes in patent papers and forcing the war-time drug factories to spend enormous sums in research to find the real recipes, the German patentees are making a final drive to persuade the Supreme Court to cancel all American licenses given by the Chemical Foundation.

Methanol, the new German synthetic alcohol, is entirely too pure, according to Dr. H. E. Howe, noted industrial chemist and officer of the American Chemical Society. This warning comes on the heels of the Harvard University report that synthetic methanol is highly poisonous. It now appears that the new alcohol is a sweet, pleasant-smelling spiritous liquid which will pass anywhere for the regular beverage alcohol.

The old wood alcohol from American distilleries is a foul liquid giving its own danger signal and is thus ideal for denaturing painters' alcohol. Germany is flooding the United States with the new alcohol, and already steps are reported taken by bootleggers to secure methanol in 10,000 gallon lots if it can be put over on the drinking public. Denatured alcohol, normally noxious from its few per cent. of wood alcohol, may be legally turned out using the treacherous German denaturant. Federal action to outlaw methanol as a denaturant may be expected at an early date.

Milk powder, now being universally introduced into bakers' bread, is very good for growing children, according to Dr. H. E. Barnard, director of the American Institute of Baking. Dr. Barnard stated further that the modern quick lunch sandwich made of milk-treated bread and containing a lettuce leaf is one of the most complete meals one can obtain on short notice, and infinitely superior to the conglomeration commonly called a business man's lunch.

The transportation of the frightfully poisonous liquid hydrogen cyanide by motor car is raising a serious new highway hazard, according to Mark Walker, cyanide expert. The liquid, of which one good whiff is instantly fatal, boils without artificial heat and must be stored in steel cylinders. Recently the material has been getting the habit of slow decomposition into gases whose pressure amounts to explosive magnitude, and a rupture of a cylinder resembles a combination of high explosive and gas barrage.

F. E. Rowlands, Oregon chemist, reported that three tons per day of Port Oxford cedar oil, a beautiful, water-white, fragrant oil, are being discarded as mill waste in one Oregon lumber district alone and a seventy-year supply looms ahead. He appealed to the chemists to find some use for this material to end the present waste.

The human nervous system is really a living telegraph line made up of a chain of electrical condensers, thinks Dr. W. R. Whitney, of the General Electric Company. This idea is sharply disputed by scientists, who say that nerve messages do not travel at the speed of electricity, but Dr. Whitney demonstrated with condenser apparatus that the transit time of a message can be slowed down even to three seconds, a time much longer than the known nerve reaction time of a human being.

Benzene, the famous chemical base of the color and drug industry, is now available from oil gas plants of the Pacific coast, E. L. Hall reported. The product will likely all go into motor fuel, as benzene is a valuable anti-knock material as well as a powerful fuel.

Where does evolution begin? Dr. Alexander Findlay, of Aberdeen, Scotland, who gave the opening address to the American Chemical Society, ventures to locate the beginnings of life not in an Asian oasis, but in the chemical colloidal particle. The noted Scotch physical chemist sees no possibility of life within the control of a simple crystal or an uncombined atom of carbon or hydrogen. However, when a few billion molecules of pulpy carbonaceous matter collect in a colloid particle, like a tiny lump of jelly, and join others of like kind, then the divine force steps in and a new chapter of science is started.

Dr. Findlay pictured the troubles of these tiny composite particles, interwoven finally into a living cell. Its problems are still those of chemistry, although a start of a biological process has been made.

Himself a lifelong member of the Church of England, Dr. Findlay is aghast at the proposition of legislative interference with the teaching of evolution, and points out that such restriction logically applies all the way down into the domain of ultramicroscopic life. No line can be drawn between the evolution of man and the elaboration of the colloid. Interference with the teaching of evolution simply means paralyzing the training of youth, who will later be fighting cancer, tuberculosis and unsolved diseases which are quite likely caused by the misdeeds of colloid particles.

The chemists actually listened to matter changing into energy when Dr. W. R. Whitney, of the General Electric Company, connected a piece of the rare metal uranium to a radio amplifier, so that the disintegration of the atoms was broadcasted over the whole theater.

It was stated that this show, if necessary, could be kept on the boards for five hundred million years, after which the uranium would cease its remarkable transformation and merely turn into a piece of lead not much smaller than the original substance. For an hour various pieces of so-called matter were put through fascinating antics in which their inner electrical energy flashed and sputtered under the stimulus of a stage full of apparatus.

Apparently coal and oil are actually energy in the form of myriads of particles of electricity. Burning coal to get power is just scratching the outsides of the constituent atoms. Unfortunately Dr. Whitney promises no immediate scheme for boring down into the central superpower zone of the carbon atom, and the enormous energy is tightly locked with bonds of unknown strength. Apparently uranium atoms are too unwieldy to keep together and disintegrate without any power of man to control the process. Unquestionably the sun contains matter of this sort and is generating energy by the atomic disintegration method, but it is impossible to observe any material deep enough in the solar body to afford a definite report on its identity.

THE AMERICAN NATURALIST

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Edited by J. McKeen Cattell

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SCIENCE NEWS

Science Service, Washington, D. C.

PREHISTORIC REMAINS IN FLORIDA

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THAT prehistoric man lived in America at the same time as did the mammoths and mastodons, and that those now extinct elephants survived in the South 10,000 to 50,000 years later than in other parts of the continent, is indicated by remains discovered by a joint expedition of the Smithsonian Institution and Amherst College near the towns of Melbourne and Vero, Florida. These preliminary results of the expedition were tentatively announced by Dr. J. W. Gidley, of the Smithsonian Institution, who has returned from Florida. Dr. Gidley, in cooperation with Professor F. B. Loomis, of Amherst, directed the excavations which revealed a crushed human skull, together with stone arrow heads, ten feet below the surface in close association with prehistoric animal remains.

Similar deposits were found in three different places near Melbourne and at Vero showing that the remains are typical of a wide extent of country. In the more recent accumulations of limestone shells, lying above the mammoth and human bones, were found fragments of pottery, while in the sands below the elephant layer were discovered the teeth of horses, camels and saber-tooth tigers typical of the pleistocene period of 50,000 or more years ago.

Dr. Gidley states that there is every evidence that the human remains were not buried in the mammoth strata at some more recent time, but that they were deposited during the same period and in a similar way to the animal bones.

The discovery of the existence of this distinct layer of ancient elephant and human relics not only shows that man was a contemporary of the mammoth on this continent as in Europe, but reveals for the first time that the big elephants probably survived for thousands of years later than has hitherto been thought. Dr. Gidley estimates that these American elephants lived in Florida perhaps 10,000 years after those whose remains were recently discovered in the former swamps of Indiana, and which have been assigned to the late pleistocene or Ice Age.

The crushed skull found at Melbourne will be pieced together in an effort to determine whether this human contemporary of the mastodon had the same type of head as modern Indians or whether he shows the characteristics of the more primitive cave man.

Exhaustive study of all the material found is now under way and a joint report will be made by Dr. Gidley and Professor Loomis.

THE CANCER GERM THEORY

SANITARY COUNCILLOR DR. LUDWIG M. WOLFF, the well-known German cancer specialist, was recently interviewed by the Paris correspondent of *Science Service* on the English cancer discoveries and the German counter-claims to have made the same discoveries some time before.

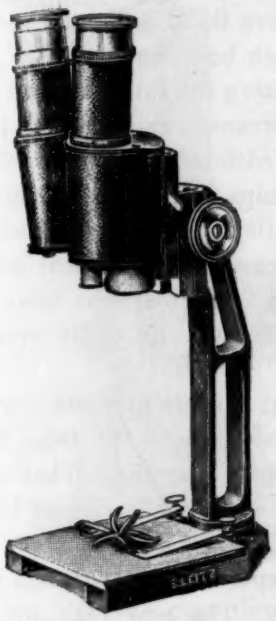
Dr. Wolff refused to make any statement for publication further than saying that it is an indubitable fact, whether the English workers knew it or not, that the results so sensationally trumpeted by the press had in fact been obtained in Germany some time before. "But," he said, "this is really of no importance at all, for, while these 'discoveries' have an undoubted scientific interest, they do not bring us an inch nearer the solution of the cancer problem. They aim at finding and isolating the cancer germ. That is to say, they aim at finding something which simply does not exist. There is no such thing as a cancer germ. There can be none. How do I know that? Very simply. Just think for a moment. We know many diseases that are caused by germs: tuberculosis, malaria, a whole series of affections of the skins, and so on. But these attack man at all ages. Bacilli take no account of age; they will attack an infant or a youth as readily as a mature or an old man. As you know, cancer is quite different; it never attacks any one under the age of 30 and extremely seldom under the age of 40. What does this mean? It means first that the cause of cancer is not a bacillus, though it is, of course, possible that the cancer condition encourages the propagation of a certain kind of bacillus, which would, however, be a symptom and not a cause of the disease. It means secondly that cancer is probably caused by some change, perhaps a chemical change, which the human body undergoes in the course of years.

"The last report of the Middlesex Hospital, in London, supports this view by recording the significant fact that cases of cancer there have been known to recover spontaneously. It is on this and similar facts that Professor Barton Scammell, the president of the Radium Institute at Dover, England, bases his idea, for which there is a good deal to be said, that owing to certain defects in the diet and the preparation of modern food, the civilized human being of to-day suffers from lack of potassium in the body and that this is one of the factors, if not the main factor, in the occurrence of cancer. It is, of course, a well-known fact that the primitive races do not suffer from cancer."

VITAMIN B

RECENT experimental work by V. G. Heller, C. H. McElroy and Bertha Garlock, of the Oklahoma Agricultural and Medical College at Stillwater, to be reported in *The Journal of Biological Chemistry*, indicates that a spore-forming organism found in the intestinal tract causes a building up and storing of vitamin B which is necessary for growth and proper development.

In carrying out the experimental work, white rats were fed on a diet of food known not to contain vitamin B. Previous experiments had shown that rats fed on this vitamin B-free diet continued to grow and exhibited symptoms of vitamin B deficiency only very slowly. It was soon found that where the rats had the opportunity to reingest some of the excretion from the intestine, the



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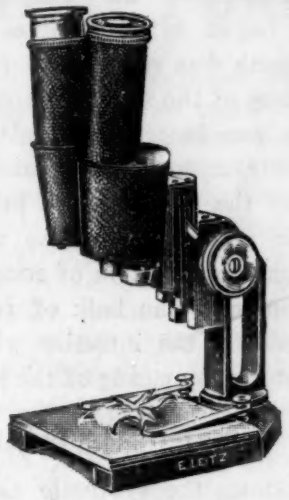

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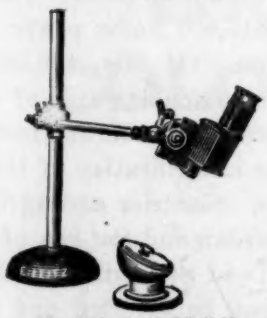

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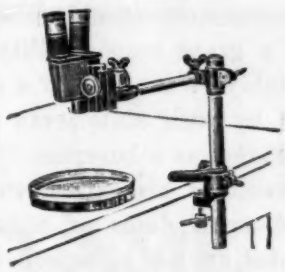

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effects of the deficient diet were very slow. The cages of the rats were then arranged so that the animals would not have access to the intestinal excretion and soon the animals began to show signs of vitamin B deficiency, their growth was retarded and death followed.

A culture of the spore-forming organism was then made and this was incorporated with their food. Almost at once the symptoms of vitamin lack disappeared, the growth of the rats returned to the normal rate and they began to thrive again. As a later refinement it was found that the addition of roughage in some form to the diet to increase the bulk of food in the intestine aided the process in the intestine whereby vitamin B is built up and stored by means of the spore-forming organism.

METHANOL

METHANOL, the synthetic alcohol which is now being made cheaply in Germany, is just as poisonous as the similar wood or methyl alcohol, despite claims that the foreign product, because of its high purity, is harmless. This statement is made by Dr. Reid Hunt, of the Harvard Medical School, in a recent issue of *Industrial and Engineering Chemistry*, following a series of experiments.

"The results with the German (synthetic) methanol were the same as those obtained with pure methyl alcohol obtained from wood distillates," says Dr. Hunt. "It can confidently be predicted that the use of the synthetic methanol as a beverage or as an adulterant will be followed by the same disastrous effects to life and vision as have characterized such uses of wood alcohol. Those who are circulating the report that the synthetic methanol is not poisonous are not only stating an untruth but are assuming a grave responsibility, for death or blindness will inevitably be the fate of a number of those who may be misled by such statements and attempt to use synthetic methanol as a beverage."

As a result of his experiments on animals, Dr. Hunt finds that small doses of either methanol or ordinary wood alcohol are not as poisonous as the same amount of ethyl, or grain alcohol; but when the doses are repeated a few times at 24-hour intervals, the methanol has the most harmful effect. This is because the animal develops a tolerance to the ethyl alcohol. Methanol, however, works differently, as it has a cumulative action, a number of small doses having the same effect as a similar amount given at once.

Man, however, is sensitive to both, and, according to Dr. Hunt, a small dose of methyl alcohol is more harmful than a similar dose of ethyl alcohol. "The more highly developed nervous system of man is more seriously affected by methyl alcohol than is that of the lower animals, and permanent blindness has often been reported from single, sometimes small, doses of methyl alcohol, whereas such results are unknown in the case of ethyl alcohol."

PLAN FOR THE ELECTRIFICATION OF PALESTINE

A NEW engineering scheme which will use the sun's energy to provide electrical power for all Palestine, make water available for the irrigation of thousands of dry acres and provide a new interior port for ocean shipping and canals for inland transportation, has been suggested by a French engineer, M. Pierre Gandillion, and accepted for execution by several French business men.

The project consists in utilizing the falls that can easily be created between the Mediterranean and the Dead Sea by carrying the water of the Mediterranan over a 260-foot ridge by means of canals, pumps and a great siphon and then letting it drop to the Valley of the Jordan and from there down into the Dead Sea, a total vertical distance of more than 1,500 feet. The Dead Sea is an inland lake and only as much water as the sun can easily evaporate will be thrown into it.

M. Gandillion estimates that the sun now evaporates all the water that the Jordan carries into the Dead Sea at the rate of about 92 cubic yards a second. That it used to evaporate much more is shown by a series of terraces at different levels on its borders, formed when the water was higher and the surface exposed to evaporation by the sun's heat therefore greater. The new plan will raise the level of the Dead Sea and evaporation by the sun will take care of the additional and regulated inflow. It is believed that evaporation of 135 cubic yards a second is easily possible and the inflow from the Jordan is to be augmented by that amount.

The scheme will necessitate the building of a sea-level canal from the port of Haiffa, on the Gulf of Akka, to a point about four miles inland. It will end in a great basin where ocean steamers can turn. From there on, either navigable canals with locks or ascensional water pipes will be built to reach the ridge at Afoule, a way station. At that point a one and one half mile tunnel will be bored through the rock and the water will run into chambers at about 262 feet above the level of the Mediterranean and about 1,125 feet perpendicularly above the Jordan, where a hydraulic turbine will be built. Another drop of 394 feet is available between the Jordan and the Dead Sea, making a total drop of over 1,500 feet.

In all, a crude force of 617,000 horse power will be generated, said M. Gandillion. Of this, 190,500 horse power will be used to lift the 135 cubic yards of water a second from the Mediterranean over the 260-foot ridge, leaving enough power for the electrification of the entire Holy Land with its railroads, industries and agriculture.

The fresh waters of the Jordan and the Sea of Galilee need not be poured into the Dead Sea with the salt water of the Mediterranean, but can be diverted and used to irrigate thousands of acres of dry land.

FIREPROOF GAS TANKS

AN aeroplane gasoline tank which may be completely riddled by incendiary or explosive bullets without bursting into flames, or even leaking, is the latest development in the aviation field which comes from Vienna. The tank is the usual metal type, but with a peculiar interior coating, the composition of which is a carefully guarded secret with the inventor, probably on the order of the liquid gums placed in automobile tires to make them puncture-proof. There is also, according to the claims of the

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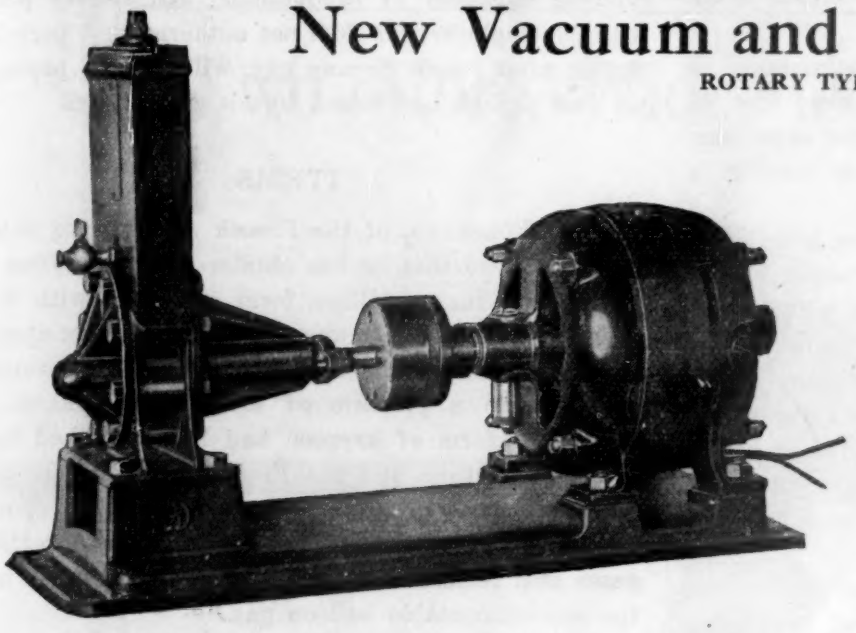

This pump is mounted on a metal base plate and connected direct to motor. It is small and compact and needs no attention when operating. The flow is continuous without pulsation.

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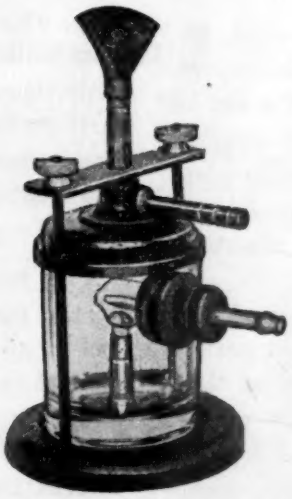

A Bunsen burner, a vessel for solution and an atomizer are mounted together. The atomizer when attached to an air supply blows a fine spray of the solution in the gas, giving a bright, broad flame with the color characteristic of the salt used. The flame if viewed edgewise gives considerable intensity. All metal parts exposed to the solution are heavy porcelain enameled.

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patentee, a special mechanism inside the tank which eliminates all the effects of explosion, either of bullets or of gas fumes.

The inflammatory bullet, upon entering the tank, is immediately enveloped with a coating of some sort of material that extinguishes the flame and at the same time prevent the phosphorus-coated bullet from leaving a deposit.

In the test made by expert army witnesses, a series of twenty bullets were fired through the experimental tank, which was filled half with gasoline and half with inflammable gas. The bullets were fired in a series of one explosive, one phosphorous and one solid, in rotation. After the twenty rounds had been fired, with no bad results, the tank was set in an aeroplane, which then made an hour's flight using only the gasoline from the apparently perforated tank. No leak or fire occurred, and no other trouble of any kind.

The invention is arousing great interest in the war department, as the figures of the past Great War taken from the German war office show that 80 per cent. of the planes brought down in flames were fired either from phosphorous bullets or caught fire from tank leaks.

REST PERIODS FOR FACTORY WORKERS

"INDUSTRIAL workers doing routine or monotonous work will steal time to rest on the job whether or not the management makes provision for rest periods," says Rex B. Hersey, of the Wharton School of the University of Pennsylvania, in urging the establishment of authorized rest periods and instruction of workers in the art of complete relaxation as a means of promoting efficiency and better production.

In an article in the *Journal of Personnel Research*, Mr. Hersey calls attention to investigations that have shown workers in certain munition plants to average seven or eight minutes of unauthorized rest out of each working hour and that in a department of a large textile plant employing about fifty girls, the bane of the production foremen's existence was the time lost through unauthorized rest.

In order to determine the value of supervised rest periods in a large factory two fifteen minute rest periods were provided, one at ten o'clock and the other at three in an eight-hour working day. During the rest periods the workers left their machines and gathered in comfortable rest rooms. Many would lie down on couches and others would sit quietly in easy chairs. Others by conversation, dancing or music would gain a relaxation that freshened their mental attitude and caused them to return to their work at the end of the period fresh and ready for the next stretch.

A comparison of the morale of both men and women workers in this factory with that of men and women in a plant where conditions were similar, except for the rest periods, showed a marked difference. Those workers who had the rest periods were more alert and on the job and were better satisfied with general working conditions.

It has been found that the rest periods promote better health, less absence from work and better spirit on the part of employees. These are important factors in increasing efficiency of production. Mr. Hersey predicts that the employer who does not authorize rest periods, no matter what wages he may pay, will soon be paying for the rest periods authorized by his competitors.

ITEMS

M. DE FORCRAND, of the French Academy of Sciences, has announced that he has obtained the heretofore inert gas, xenon, in crystalline form combined with 6 or 7 molecules of water. It was made in a Cailletet apparatus when pure xenon in the presence of a little water was subjected to a pressure of several atmospheres. The crystalline form of krypton had been obtained by him two years before, and the French scientist, M. Villard, discovered that of argon. But the xenon compound is the most stable of these. Three of the six known "inert" gases still remain obdurate, and among these is helium, the non-inflammable balloon gas.

THE heavy earthquake reported from observatories at Chicago and other cities, on August 19, occurred under the sea off the coast of northeastern Asia, according to calculations made by Commander H. N. Heck, of the U. S. Coast and Geodetic Survey. Data were sent in by observatories of the survey at Tucson, Ariz., and Cheltenham, Md., and by the Dominion Observatory at Ottawa, Canada. The calculations showed that the epicenter, or point of greatest disturbance, of the quake was located at latitude 55 degrees north, longitude 165 degrees east, in the neighborhood of the Kamandorski Islands, off the coast of Kamtchatka. Commander Heck said: "In this region there is a tremendous undersea trough, 18,000 feet deep, which is a famous location for earthquakes. The most violent quakes in the world happen here, but they do little damage, for there is nothing to damage." The earthquake reported on the same date from Porto Rico was an insignificant local affair, Commander Heck stated, and had nothing to do with the big quake of the north Pacific region.

THE return of Borrelly's comet to within one degree of the position predicted for it by Dr. A. C. D. Crommelin, of Greenwich Observatory, England, on its last visit to the nearer parts of the solar system, seven years ago, is announced by Dr. Harlow Shapley, of the Harvard Observatory, who received the news through the great international clearing house for astronomical happenings at Copenhagen. The rediscoverer of this comet, which comes back once in approximately seven years, is Dr. A. Schaumasse, who detected it at the astronomical observatory at Nice, France. It was at this observatory also that it was first detected at its most recent return in 1918. France also claims the honor of its first discovery, which was made in 1889 at Marseilles, by the noted astronomer Borrelly. The comet, which is still too faint to be seen with the naked eye, was located at right ascension 5 hours, 4 minutes, 24 seconds, and declination plus 2 degrees, 4 minutes. This places it in the neighborhood of the well-known constellation of Orion, which rises this month at about two o'clock in the morning.

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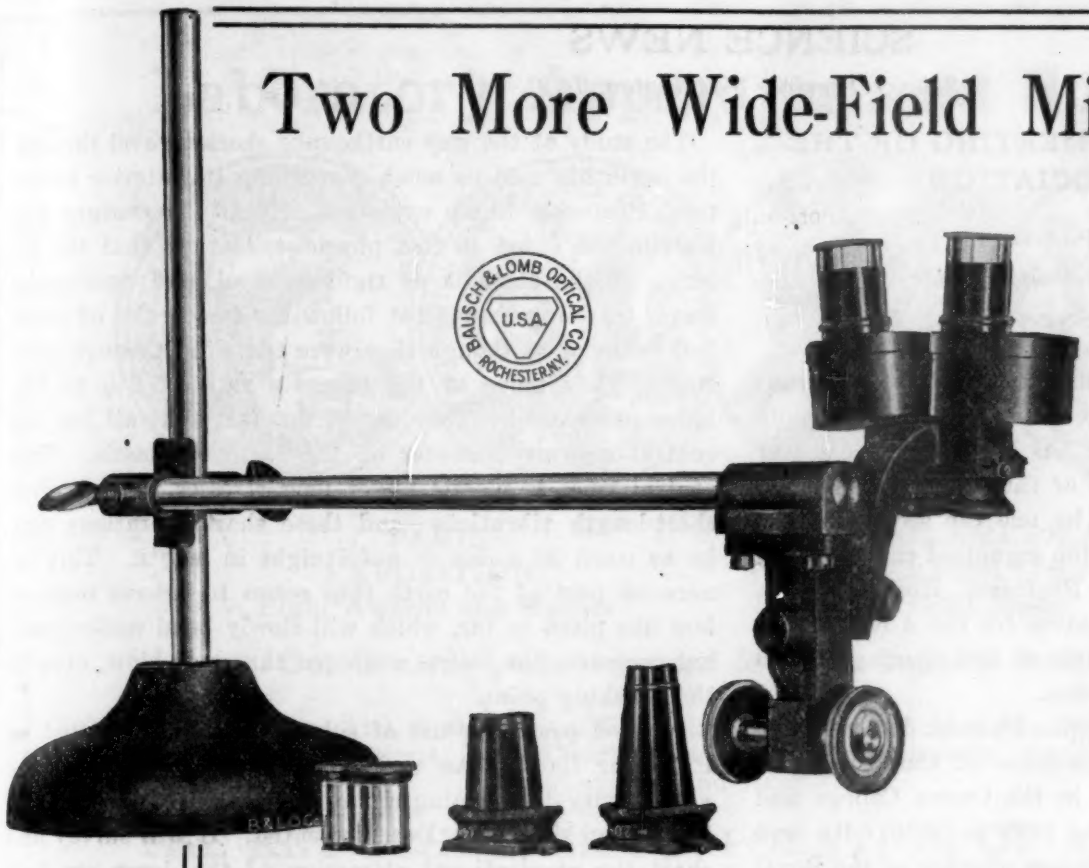
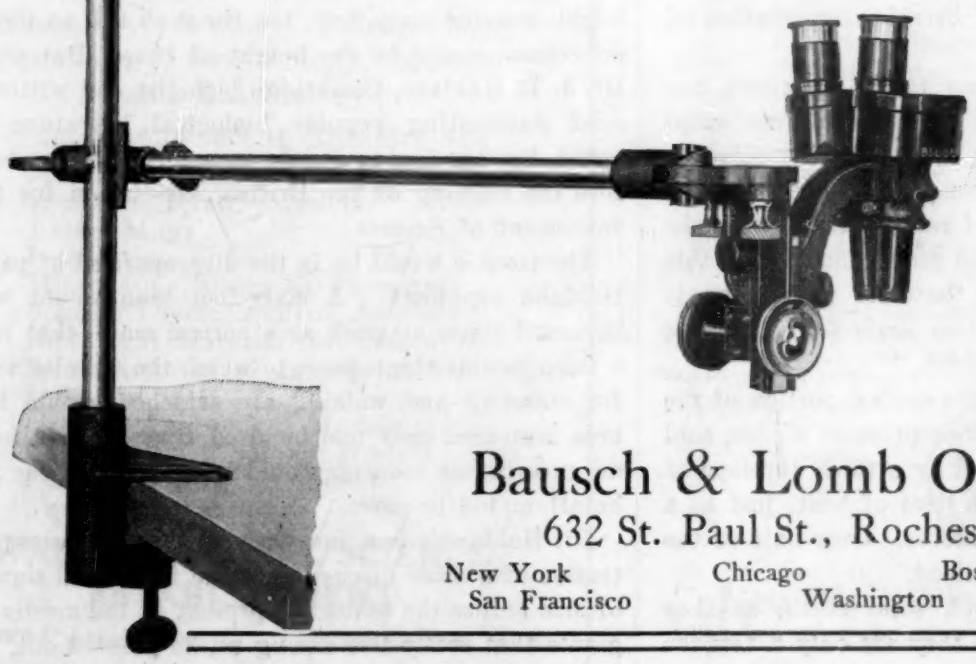


Model SK

The two stands illustrated on this page greatly extend the uses of this New Wide Field Binocular Microscope. Model SK is equipped with a heavy base stand, weighing 17 pounds.

The clamp stand illustrated below, Model CK, is interchangeable with either the heavy base stand or the regular stand that was illustrated and described in the July 17th issue of Science.



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SCIENCE NEWS

Science Service, Washington, D. C.

THE SOUTHAMPTON MEETING OF THE BRITISH ASSOCIATION

By Watson Davis

Managing Editor Science Service

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Man can look millions and millions of miles into stellar space, but has not penetrated the earth directly more than a mile or so. Yet science has been able to discover the constitution and properties of this ball to which man is fixed during his life. One by one the secrets of the globe are being surrendered to the organized curiosity and ingenuity of man, declared Professor Horace Lamb, president of the British Association for the Advancement of Science, in his annual address at the opening session of the association at Southampton.

Professor Lamb is one of England's most distinguished mathematical scientists. A graduate of Cambridge, he was professor of mathematics in the Owens College and University of Manchester from 1885 to 1920. He is a fellow of the Royal Society, foreign member of the Royal Academy Di Lincei of Rome, and has received honors from many universities.

In his address, Professor Lamb explained that the earth, instead of having a molten, flaming center, as was formerly supposed, has a hard, rigid metallic heart, as stiff as steel. Sixty miles below the surface is a stratum of viscous material, neither solid nor fluid, on which the mountains literally float. The heaviest and densest parts of the earth's crust, he stated, are the sea bottoms.

Since the crust of the earth hardened and became relatively stable, Professor Lamb said, somewhere between one billion and ten billions of years have elapsed, an age for the earth giving "ample scope for the drama of evolution." Compared with this, the six thousand years allowed by the Fundamentalists' literal interpretation of the Bible is mere watch-tick.

The age of the earth, Professor Lamb explained, has been scientifically estimated by a study of the radio activity of the rocks of which the crust is composed. Radium and similar elements decompose at a known rate, and by comparing the degrees of radio activity of rocks of various geological periods, and noting how much this activity has "slowed down" in the older formations, it has been possible to establish a time scale for the age of the crustal rocks.

Although not a flaming mass, the central portion of the earth is as hot as the primitive conception of Hades, said Professor Lamb, for it is enclosed by a thick envelope of material that is but feebly conductive of heat, just as a steam boiler is jacketed with asbestos. Over half of the earth's original heat is thus retained.

Tides move through this rigid, solid earth, as they move through the ocean; though they are only a few ten thousandths of an inch instead of the many feet we see in the oceanic tides.

The study of the way earthquake shocks travel through the earth has told us much concerning its interior condition, Professor Lamb explained. Nearly a century ago Kelvin, the noted British physicist, learned that the interior of the earth is as rigid as steel, and earthquake waves traveling through it follow the same rules of physical behavior as though they were traveling through solid steel. They move at the leisurely rate of 2½ to 7½ miles per second. They reveal the fact that all but the central quarter diameter of the earth is elastic. This central mass is plastic under long stresses, but rigid to short-length vibrations—and these short vibrations may be as much as a day or a fortnight in length. This innermost part of the earth thus seems to behave more or less like pitch or tar, which will slowly bend under gradual pressure, but resists a sudden thrust or blow, even to the breaking point.

A novel peacetime use of submarines was predicted by Professor Lamb. An undersea vessel planned to carry new gravity-determining apparatus has been perfected by Dr. Victor Meinesz, a Dutch scientist. It will survey and chart the gravitational attraction of the dense sea bottoms, now inadequately known.

An Adamless insect Eden was disclosed by the report of a special committee. Moths and sawflies, under the observation of these scientists, had propagated their kind for thirteen and nine generations, respectively, without the intervention of the male of the species. During all this time no weakness was discovered, and only eight males appeared among two thousand insects produced by this scientific virgin birth. Such extreme feminism is known to scientists as parthenogenesis. The committee now proposes to apply their methods to the production of vertebrate animals, such as frogs.

Imagine a human giant sixty feet tall. Small boys, impatient at the slowness of the growing-up process, might imagine sixty feet, ten times as tall as the tallest policeman, would be the height of bliss. But would it? Dr. J. B. Haldane, Cambridge biologist and writer of the most fascinating popular biological literature in the world, has his doubts and he expressed them recently before the meeting of the British Association for the Advancement of Science.

The trouble would lie in the disproportion of parts, Dr. Haldane explained. A sixty-foot man would weigh a thousand times as much as a normal man—that is, about a ton—but his thigh bone, to which the muscles necessary for standing and walking are attached, would have its area increased only one hundred times. Therefore such an unfortunate monster would break his legs the moment he attempted to move.

Dr. Haldane's imaginary giant was a picturesque illustration of a sober discussion of the functional significance of size before the biologists present at the meeting. The giants that really live among us, he pointed out, like the elephant and rhinoceros, have their legs thickened to an extent that seems disproportionate to us, but this is

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necessary if their unwieldy bulk is to be moved at all. The whale gets along with a relatively slight skeleton, because most of his immense weight is buoyed up by the water.

Small size, Dr. Haldane continued, confers certain advantages.

A mouse falls down a mine shaft third of a mile deep without injury; a rat falling the same distance would break his bones, a man would simply splash.

Other factors than simple physical strength of bone and muscle material limit size, however. Dr. Haldane pointed out that there is no reason why a whale should not grow to unlimited size except that his digestive system is relatively limited. His enormous mouth is testimony to the difficulty of keeping so huge a body fed. There would be no reason why insects as large as men should not exist, except that they do their breathing by tubes reaching into their bodies and opening directly to the surface, with no provision such as we have for getting air in and out. Even the monstrous dragon flies of the remote past, which had a two-foot wing spread, had bodies as slender as a lead pencil, limited by the inefficiency of their breathing apparatus.

Eyes seem to increase in efficiency with the ratio of their size to the size of the body. Dr. Haldane suggested that Dr. Barnard, co-discoverer of the cancer germ, might breed elephants with eyes relatively as large as mouse eyes, for such yard-wide optical organs would see ultra-microscopic objects.

Dr. Haldane does not think much of the flea's vaunted superiority as a jumper. Ability to jump, he said, is independent of size, the real champion jumpers of creation are man and his friend the horse, both of whom can make seven-foot leaps. The best the flea can do is a foot.

The exhibition of the biological section of the association rivalled Dr. Haldane's imagination. B. K. Das, a scientist from the Orient, showed living specimens of the famous climbing fish of Bengal, India. This species, known as *Anabas scandens,* quite lives up to his name—"scandens" means "climbing"—for it actually does climb coco trees. Dr. Das, however, denied the rumor that it invades gardens and battles with its fellows over angle worms as robins do. So used is this fish to being out of water that it drowns if kept in it too long. It absolutely must have atmospheric air to breathe.

There are five species of Indian fish that have developed air-breathing apparatus, some with, others without, auxiliary gills. This, it was pointed out, is an example of present-day evolution quite different from the way amphibians and higher animals arose.

A report on English dietary presented at the meeting shows that the "roast beef of old England" is losing ground. Roast pork is gaining preference, eggs and bacon still hold their old place as a breakfast dish. The English seems to be growing fonder of potatoes.

Snatched from the realm of the infinitesimally small and magnified to visibility on the stereopticon screen, the organism blamed for human breast cancer was shown to the scientists assembled at the meeting of the British Association for the Advancement of Science. These minute bits of living matter, so small that they can pass through the pores of a fine porcelain filter able to strain out of a solution the smallest bacteria visible under a powerful microscope, can be detected only by means of the ultra-microscope.

The latest developments in the ultra-microscope are the work of J. E. Barnard with Dr. Gye, co-discoverer of the cancer germ, who addressed the association. The ordinary microscope using its highest power can make visible to the eye objects as small as the shortest wave length of visible light which is roughly speaking about one five hundred thousandths of an inch long.

The ultra-violet radiations, however, have even shorter wave lengths with which one can pick out objects invisibly small and though they can not make them directly visible to the eye they can register their image on a photographic plate. The ultra-microscope makes use of these rays of extremely short wave lengths, and since these rays can not pass through glass, it is equipped with lenses of pure quartz. With this instrument the hitherto invisible filter-passing organisms have been detected and photographed.

But Dr. Barnard is not yet satisfied with his conquest of the infinitely little; he is reaching out into worlds smaller still and is now building a super-ultra-microscope using Schuman rays, which have the shortest known wave length, passing them through fluorite lenses in a vacuum, thus avoiding even the disturbing effect of air. With this apparatus he expects to be able to register on the photographic plate the images of actual molecules of matter as well as the still unknown germs of small-pox, measles, whooping cough and other diseases due to filter-passing organisms. As an example of the size of the objects he hopes to photograph, Dr. Barnard mentioned the starch molecule, which is calculated to be only one one hundredth the size of the filter-passing organisms now being photographed.

The use of the intense cadmium light now permits Dr. Barnard to get photographs of his organisms enlarged to three thousand diameters in one tenth of a second. This opens the way to motion picture records of the growth and activities of germs. This huge enlargement shows the jelly-like agar culture medium on which germs are commonly cultivated to have a spongy structure, with channels of fluid in it, like a field cut by irrigation ditches. In the ultra-microscopic landscape the cancer germs take the place of cows feeding on the banks. This discovery will be of practical value in the laboratory, where germs are grown for purposes of experiment.

The Britons were addressed by a noted American scientist, Professor Yandell Henderson, the Yale physiologist. Dr. Henderson's topic was congenial to British as well as American tastes, for it concerned athletics. The normal human heart, he said, pumps one and one half gallons of blood each minute, while that of a vigorous athlete circulates eight to nine gallons. The heart action decreases from thirty to forty per cent. when a normal person stands up.

The history of Egypt was pushed back to a time thirteen thousand years before Christ and hooked up with the later old stone age of Europe when Sir Flinders Petrie, noted Egyptologist, discovered beneath the oldest pre-

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viously known settlement the remains of a flint-using culture similar to that known in Europe as the solutrean.

An ivory statue that was unearthed links Egypt with Asia, at an extremely early date.

Pottery finer and thinner than any made subsequently was also found. The culture or civilization period thus marked has been named the "Badrarian," from the place of its discovery, near Asyut. Its antiquity was determined accurately by a study of the successive yearly floodmarks of the Nile.

The early civilization of Britain was connected with that of the Egypt of Tutankhamen's day by Sir W. Boyd Hawkins, who discovered buried at the famous and mysterious Stonehenge a number of Egyptian beads dating from the reign of Tutankhamen's predecessor and father-in-law, Anhnaton, in 1360 B. C.

This is the first clue to the date of these megalithic monuments, which have long been one of the great archeological riddles of the world.

THE TRANSMUTATION OF LEAD

FURTHER evidence in favor of the transmutation of the elements comes from the experiments of Arthur Smits and A. Karsen, of Amsterdam. They followed the general method by which Professor Miethe, of Berlin, claims to have obtained gold by passing a strong electric current through mercury vapor. The Amsterdam chemists undertook the decomposition of lead instead of mercury. This was more difficult, since lead is converted into vapor at much higher temperature, and considerable time was consumed in constructing a practicable ultra-violet ray lamp of quartz with lead in place of quicksilver.

The rays given off were examined with a quartz spectroscope. After a current of thirty to thirty-five ampères under a pressure of eight volts had passed through the apparatus for six hours certain lines characteristic of mercury began to appear in the spectrum. These gradually strengthened until after ten hours the entire series of mercury lines and also those of the rare element, thallium, were perceived in the visible and ultra-violet parts of the spectrum.

The lead employed was specially prepared and purified for the purpose by Kahlbaum, of Berlin. If the lead was indeed absolutely free from other metals, the experiment appears to prove that lead can be broken up into at least two other elements.

The question of possible impurity of the metal at the start is the basis of the criticism of these alleged transmutations. A new and sharp attack on Miethe's experiments comes from the laboratory of the Berlin University Chemical Institute where E. H. Riesenfeld, Wilhelm Haase, Erich Tiede, Arthur Schleede and Frieda Goldschmidt find that the process of purification employed by Miethe prior to the passage of the electric current did not altogether remove the traces of gold that occur commonly in mercury. By distilling the mercury three times in a vacuum they were able to obtain mercury that gave no indication of gold, even by the most delicate test, and when this was used in an electric lamp according to Miethe's method, no gold was obtained.

But Professor Miethe says: "My newest method yields an amount of gold far greater than my previous method; in fact enough to permit me to determine gold by the standard chemical tests." This new and more powerful method has not yet been tried on the Riesenfeld gold-free mercury.

Professor Miethe also found, besides the gold, traces of another metal in the mercury and this he takes to be silver. Professor Nagaoki, of Tokyo, who reported getting gold from mercury by electrical action, also found a white metal which he thinks is platinum.

If these experiments are confirmed, chemists have acquired the power of changing lead into mercury and thallium, and then the mercury into gold and silver or platinum. This would open a new era in the sciences, the synthesis of the elements.

ITEMS

THE female sex principle, recently detected for the first time by Dr. Edgar Allen, of Columbia, Mo., and J. P. Pratt, of Detroit, has been isolated from the circulating blood of a number of animals by Dr. Robert T. Frank, of the Research Laboratory of the National Jewish Hospital for Consumptives at Denver. Dr. Frank found that the secretions in the blood are much greater at periods of high sexual activity than at others, and it seemed that the blood or extract of it at such times might be used to induce normality in other animals and even human beings who are below normal. It was absent from the blood of males and of sexually subnormal females.

SCIENTISTS have upset the dope of hard-hearted trainers who rule candy off the diet of athletes. Dr. Burgess Gordon and several other physicians of Boston have found as a result of experiments that marathon runners who have lived on a generous carbohydrate diet during the training season and who eat candy before and during the race not only come out ahead but are also in much better physical condition than those who run unsweetened. The experimenters got the hint that sugar had something to do with the physical condition of runners when a series of blood tests made a year ago after the American marathon race, revealed that those who were most exhausted showed very low blood sugar and others, less exhausted, showed a somewhat higher sugar percentage. Some extreme cases even presented an appearance similar to that of shock produced in diabetic patients by an overdose of insulin, a substance necessary to the proper disposal of sugar in the blood and which diabetics lack. Results of blood tests made accordingly, using sugar rations during this year marathon, have just been made public. Runners were placed on high carbohydrate diets before the race, besides being given large doses twenty-four hours before and supplied with candy and oversweetened tea at wayside stations. The blood tests after the race showed normal blood sugars in all cases in contrast to previous results. There was striking improvement in general physical condition and running time was faster in many cases.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE SOUTHAMPTON MEETING OF THE BRITISH ASSOCIATION

By Watson Davis

Managing Editor, Science Service

ATHLETIC RECORDS

What kind of sport a student is most likely to excel in may be determined by a physiological examination, according to Professor A. V. Hill, of London University. In giving the presidential address before the physiological section of the British Association for the Advancement of Science in session at Southampton, he showed curves, based on many years of experimentation, from which it is possible to tell how many yards a man can run without exhaustion, and what is his best speed. He finds that this depends chiefly upon the ability to supply sufficient oxygen from the air and to dispose of the products of combustion accumulating in the muscle from exertion. The oxygen used by the body is the measure of the energy expended. One liter of oxygen, about a quart, would be sufficient, if it could be used with a hundred per cent. efficiency, to raise a weight of one ton to a height of seven feet.

In running, the oxygen needed increases as the square or cube of the speed. That is, running twice as fast requires from four to sixteen times as much oxygen per minute. A man taking 240 steps per minute may consume eight liters of oxygen a minute, while if he speeds up to 280 steps he may require twenty-four liters. But a runner may for a short time consume more oxygen than he can breathe in, just as a man may for a while spend more than his income. An athlete, for instance, may have a maximum intake of four liters a minute and be capable of running into debt for oxygen to the extent of fifteen liters. If then he was running at a speed requiring five liters of oxygen a minute, he would have to draw on his reserves at the rate of a liter a minute and at the end of fifteen minutes would be exhausted.

This possibility of thus overdrawing one's oxygen income depends upon a mechanism of the muscle by which lactic acid, the sour milk acid, may be accumulated to be oxidized off when the exercise is over. The muscles therefore serve as storage batteries for energy to be drawn upon in an emergency and recharged when the man has leisure to catch his breath again. The inability of women to match the highest athletic records of the men is due to their lesser energy reserve. Women may have as much skill as men, but, on the average, they can expend in a given time only 67 per cent. of the energy available to men. Dr. Hill suggests that "an enterprising woman athlete who wants to break a record should avoid the 300 meters; she would be well advised to try the 500 meters."

The scientific study of the feats of trained athletes discloses facts that would have appeared incredible. For instance, Dr. Hill says of the mechanics of high jumping: "Paradoxical as it may seem, it is possible for an object to pass over a bar while its center of gravity passes beneath; every particle in the object may go over the bar and yet the whole time its center of gravity may be below. A rope running over a pulley and falling on the other side is an obvious example. It is conceivable that by suitable contortions the more accomplished high-jumpers may clear the bar without getting their centers of gravity above or appreciably above it. Let us calculate, however, on the assumption that the center of gravity of a jumper just clears the bar. The world's record high-jump is 6.61 feet, the center of gravity of the performer being presumably about 3 feet high at rest. He raises it therefore 3.61 feet into the air, from which we may calculate that the whole time occupied in the jump is about 0.96 second. Seeing the amazing complexity of and the skill involved in the rapid movements and adjustments involved in a record high-jump, it is striking that all those events can occur within a time of less than one second."

THE DRIFTING MOTION OF CONTINENTS

Are America and Europe drifting farther apart? This question, asked in a geological and not in a political sense, was set before the meeting of the British Association by Professor J. W. Gregory, who proposed to answer it by the use of wireless time signals for the determination of variations in longitude. Kept up for a few years, he said, these would afford a conclusive test of the theory recently advanced by Wegener, that the Atlantic Ocean was produced by the drifting apart of the Americas on one side and Europe and Africa on the other.

The reality of a drifting motion of whole continents is now seriously accepted by many geologists. Recent investigations have shown that beneath the uppermost sixty miles or so of rocky crust, there is a semi-molten layer of magma or lava overlying the earth's solid central core, and on this viscid mass the continental blocks find more or less uncertain footing. The idea of a drift also receives support from the rather suggestive reciprocity of the projections and indentations of the Atlantic shores of America and the Eurafrican coastline.

Professor Gregory was not inclined, however, to admit the rapidity of drift postulated by the Wegener theory, and it is to get a critical test of this disputed question that he proposed the use of radio time signals.

THE GALILEE SKULL

Man in Neanderthal times was divided into distinct races just as he is to-day, according to the evidence of the newly discovered Stone Age skull found near Capernaum in Galilee. Discussing the find before the meeting of the British Association Sir Arthur Keith characterized the man to whom the skull had once belonged as a twenty-five-year-old representative of a new race of the Neanderthal type, differing from the European Neander-

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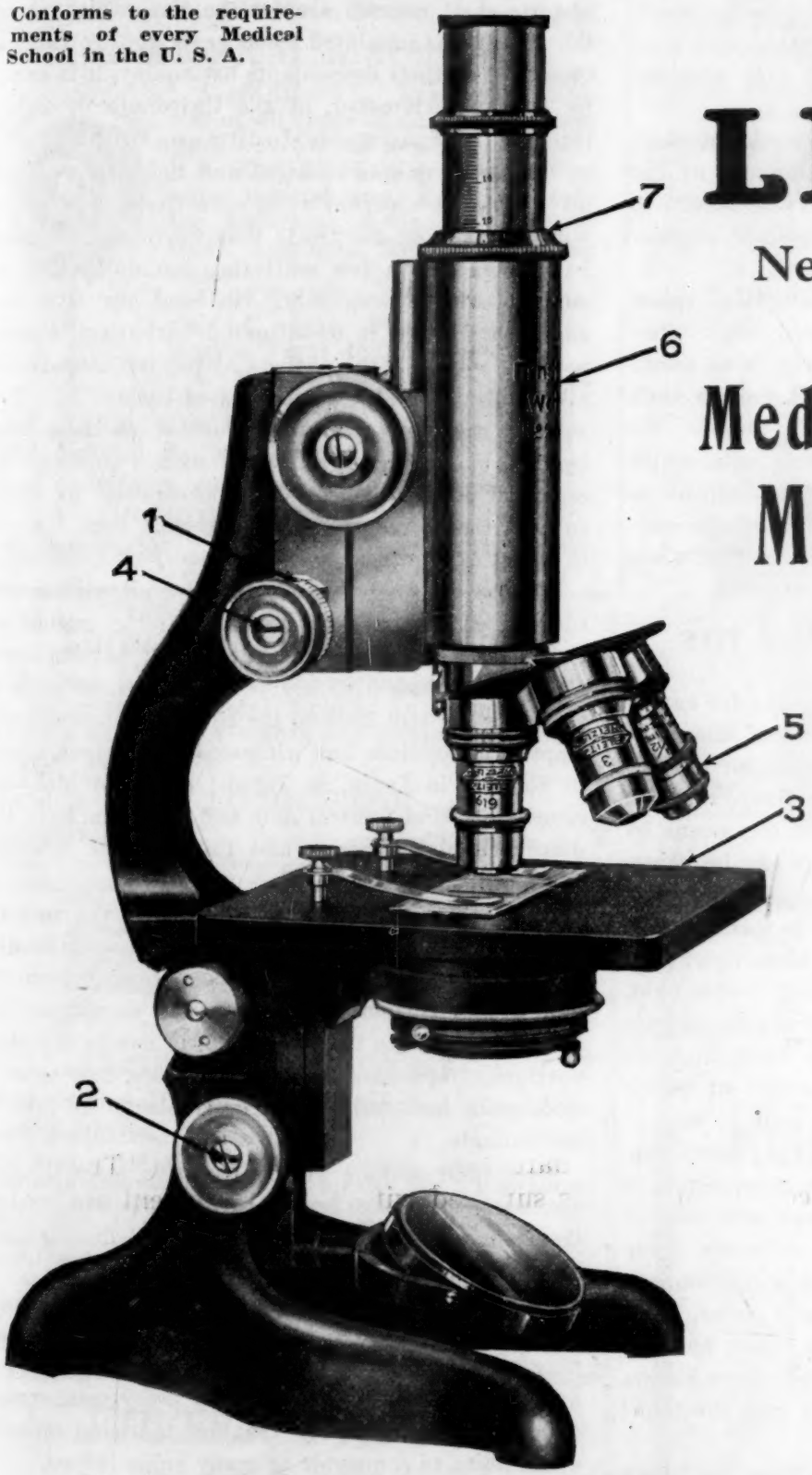

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thal skull previously known in being relatively high and narrow. This Neanderthaler of ancient Palestine had a brain showing the development of the higher faculties, including probably even speech; it has long been considered doubtful whether men of the Neanderthal ages were really capable of articulate speech, though they were undoubtedly human beings.

Implements and animal remains found with the skull show that it corresponds to the Mousterian era of the Old Stone Age in Europe, estimated at from 25,000 to 50,000 years ago. Three healed wounds indicate trephining, or possibly some mysterious disease.

The British scientists also had their attention called to the problem of the emotionally abnormal child. Professor Cyril Burt stated that about one tenth of all school children are emotionally unstable, and that one per cent. are actually menaces to themselves and the public. We all have within us the potentialities of criminals, which are kept in check by habits inculcated through education. A systematic program for the stabilization of the emotionally unsteady child is one of the prime present needs of our educational systems.

THE ULTRA-MICROSCOPE AND THE CANCER GERM

THE filter-passing organism held responsible for cancer of the breast was held up for all the world of science to see, at the meeting of the British Association for the Advancement of Science. J. E. Barnard, co-discoverer with Dr. Gye of the cancer germ, demonstrated the means by which these almost infinitely small objects can be photographed.

The ultra-microscope, the chief weapon in this research, makes use of the invisible, short-length ultra-violet rays instead of the longer-length rays of ordinary visible light. These shorter-length waves can pick up objects shorter than the shortest wave-length of visible light, and can be focused on a photographic plate by means of quartz lenses, thus making pictures of things too small to see.

But Mr. Barnard is not content with his present conquests with the ultra-microscope; he is constructing a super-ultra-microscope that will photograph even smaller organisms and probably the non-living molecules themselves, some of the larger of which are still only one one hundredth of the size of the invisible cancer germs. This instrument will be equipped with fluorite lenses, and will use Schuman rays, the shortest-length radiations known. It will be operated in a vacuum, to avoid even the slight disturbances due to the presence of air.

Possibilities of getting germs into the "movies" were suggested by Mr. Barnard, who has found that by means of the intense cadmium light he can get enlargements up to 3,000 diameters in one tenth of a second. Under these magnifications, the jelly-like agar medium on which bacteria are cultivated shows up as a spongy structure, cut through with liquid-filled canals, like irrigation ditches in a field. In this ultra-microscopic world the germs play the rôle of cows feeding on the banks.

INDIANS OF THE SAN FRANCISCO BAY REGION

LIVING in exactly the same place, with exactly the same customs, for three and a half thousand years, the Indians of the San Francisco Bay region, in California, take the palm for conservatism. This long and unchanging record has been exposed by excavations of partly submerged prehistoric shell mounds around the bay, which show that the region was inhabited 3,500 years ago by Indians who then lived as their descendants live to-day, it is announced by Dr. A. L. Kroeber, of the University of California, through the Smithsonian Institution, Washington.

"When Troy was besieged and Solomon was building his temple, at a period when even Greek civilization had not yet taken on the traits that we regard as characteristic, when only a few scattering foundations of specific modern culture were being laid and our own northern ancestors dwelled in unmitigated barbarism," according to Dr. Kroeber, "the native Californian already lived in all essentials like his descendant of to-day."

There are few parts of the world, even those inhabited by dark-skinned savages, where such a condition can be regarded as established. The permanence of California culture, therefore, is of far more than local interest. It is a fact of significance in the history of civilization.

If it be objected that the period dealt with is after all conjectural rather than established, the import of our inference may be diminished; but it is not destroyed. Cut the estimate of 3,500 years in half, or even to one third, we are still back to the time of Charlemagne. The elapsed millennium has witnessed momentous alterations in Europe, in India, in Japan; even the Mohammedan countries, China, Central Asia and Malaysia, have changed deeply in civilization, while this part of America has stood still.

Dr. Kroeber bases his inferences upon the fact that all classes of objects found in these shell-mounds were unearthed with practically the same frequency from the top, middle and bottom of the heap and show that the prehistoric people ate the same food, in nearly the same proportions, prepared in the same manner, and sewed skins, rush mats and coiled baskets similarly to their recent descendants.

Even their religion was conservative, since the identical charms seem to have been regarded as potent. In a word, the basis of culture remained identical during the whole of the shell-mound period, he declares.

The age of the mounds is estimated by the time necessary for the shells to have accumulated, supposing that they represent the débris of a large hamlet of 100 people and allowing 50 mussels a day for every man, woman and child. Experiments show that five thousand mussel shells crush down to a quarter as many cubic inches.

The population may have averaged more than one hundred, Dr. Kroeber admits, but this would be a rather high figure for a native California village. It may also have been augmented seasonally by visitors from the interior, but to compensate, its own inhabitants are likely to have spent five or six months of each year away from their mussels. "However the question is approached," he maintains, "3,500 years seems to be a conservative estimate."

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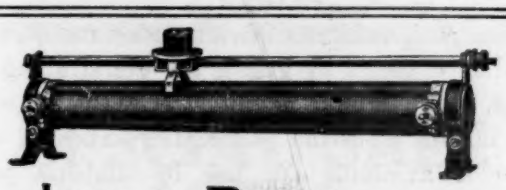

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of cripples, has responded to the good influence of the sun's rays. Dr. G. Murray Levick, medical director of the Heritage Craft Schools at Chailey, Sussex, who originated the treatment, said that no other method has ever had as good results as this in the treatment of infantile paralysis.

Dr. Levick first deduced that neurasthenia in grown-ups and rickets in the young are due to the same cause. Both these diseases, he claims, are nutritional disturbances of the nerve centers affecting the bones in the young, and the nervous systems in the old. The action of sunlight on the skin forms a substance which is carried into the blood and feeds the nerve centers as well as the bones. His success in treating neurasthenia with sun's rays led him to apply it to cases of infantile paralysis, a disease which is a severe shock to the nervous system and which results in muscular atrophy. Under the action of sunlight a renutrition of nerve centers takes place.

Synthetic sunlight produced by him with an electric arc light of his own invention proved as good as natural sunlight, and could be better regulated to the patient's endurance. He used two distinct kinds of light rays, the short ultra-violet rays for nerve nutrition and the long red and infra-red rays for muscle treatment. Red rays, as can be seen when the hand is held up against the sunlight, penetrates the flesh to a considerable extent, and can therefore stimulate the sleeping muscle.

Dr. Levick warns that immediate success must not be expected. He has found constant improvement where daily short treatments were continued over a period of several years. While the method may not be effective in extreme cases, it is nevertheless a test which will soon show after a few treatments whether any rejuvenation of the nerve fibers is taking place.

THE DISASTER TO THE SHENANDOAH

THAT *The Shenandoah* disaster will have no more effect on the progress of development of aircraft than previous similar wrecks have had is the opinion of Dr. Richard B. Moore, of New York city, who was the first to propose the use of helium in an American airship, and who, when chief chemist of the U. S. Bureau of Mines, worked out the process for producing the rare gas in quantity.

"*The Shenandoah* was simply caught in a storm that was too severe for her or for any other type of aircraft," said Dr. Moore in a statement to *Science Service*. "Before I learned the details I thought that possibly something had gone wrong with the steering apparatus, or that a flaw had developed in the metal framework; but apparently even this was not the case. That storm would have wrecked anything that tried to fly through it.

"Such danger can never be eliminated, any more than wrecks of automobiles, airplanes or railway trains can be entirely done away with. But it has already been greatly reduced and further improvements are sure to be made.

"Lighter-than-air craft are safer to-day than airplanes. Twice recently, great dirigibles have weathered severe storms, and though severely damaged have returned under their own power to their hangars, under conditions utterly unsafe for airplanes.

"Improved construction of metal parts of airships will help reduce the chances of accident; but the greatest need of constructional improvement at present is probably the development of the steering gear to a point where it will handle the ship under extreme weather conditions. Engines burning heavy oil will also be a boon.

"The disaster has shown again the great value and absolute necessity of helium and proved also that gasoline is not the fire hazard it has been believed by some. Hydrogen is a much greater fire hazard than gasoline, and this hazard helium eliminates entirely. Without helium *The Shenandoah* would undoubtedly have burned, causing much greater loss of life. The disaster was bad enough, but not nearly as bad as some that have taken place in the past, where hydrogen was used instead of helium, so that fire played a major part.

"Our commercial supplies of helium should be considered by the nation as a great asset, and supported adequately by the congress, as an important means of national defense as well as for progress in commercial aviation. Helium should always be used until the danger of structural defects in the ships is less, and flying efficiency is definitely established.

"I believe personally that the accident to *The Shenandoah* will only shake the confidence of the public for a short time, and that commercial airships will be crossing the Atlantic within a few years. I am emphatically of the opinion that the congress should appropriate money to replace the lost *Shenandoah* at once."

ITEMS

THAT the continued use of insulin may really cure and not just allay diabetes by giving the overstrained glands a long rest, is the opinion of Dr. F. G. Banting, who first extracted insulin from the pancreatic glands of animals and made it available for use by diabetic patients. "Regardless of the severity of the disease," said Dr. Banting, "all patients may now be maintained sugar free. Since this is possible it is to be strongly advocated, for we have abundant evidence that there is a regeneration of the islet cells of the pancreatic glands when the strain thrown upon them by high blood sugar is relieved. In some moderately severe cases the carbohydrate tolerance has increased sufficiently so that insulin is no longer necessary."

FOR the first time in history, the development of the embryo of a warm-blooded animal has been carried on under such conditions that it can be watched continuously. This feat has been accomplished by two scientists at the University of Leyden, Drs. J. P. M. Vogelaar and J. B. van den Boogert, who have placed common hens' eggs, with the shells removed, in small glass dishes in an incubator, and have succeeded in keeping the embryo alive and growing for five days. Hitherto the only way in which such embryos could be studied has been by placing large numbers of eggs in the incubator, and removing and opening them one by one at intervals. By this older method it has been possible to study closely spaced stages of development, but not to observe the growth as a continuous process, now made possible by the new way.

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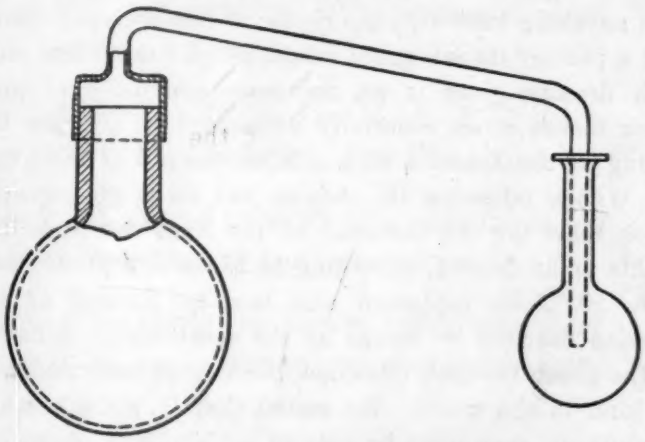

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SCIENCE NEWS

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ASTRONOMY AT NORTHFIELD

In spite of all attacks, the theory of relativity is still on a firm foundation, according to Dr. Charles E. St. John, of the Mt. Wilson Observatory, who has been attending the meeting of the American Astronomical Society at Northfield, Minn. All the tests of the theory suggested by Einstein, and several he did not think of, have supported the theory when put to trial.

One of the crucial tests of relativity consists in measuring the spectrum shift. If light has mass, as the Einstein theory postulates, it is subject to gravitational attraction. Therefore the sun would tend, at least slightly, to pull back its light even at the moment it sends it out. This would lead to the displacement of the color lines in the sun's spectrum as compared with the spectrum of a source of light having little gravitational attraction, like an arc light here on earth. Dr. St. John made this test with delicate instruments and found the predicted shift.

Since then other astronomers have looked for this effect, and they say that there is such a shift, but that it varies with the lines, the stronger ones showing more shift than the fainter, which is not in accord with the relativity theory. However, Dr. St. John, working with the world's most powerful spectroscope on the 150-foot tower telescope at Mt. Wilson, has not found this variation.

Finally, the work of his colleague, Dr. Walter S. Adams, director of the Mt. Wilson Observatory, has shown the Einstein shift elsewhere in the heavens. The dog-star, Sirius, which is a conspicuous object in the late summer sky, has a small companion star, not visible to the naked eye. Though small, it is enormously heavy, denser by far than anything known on the earth; it has been calculated that a pint of its substance would weigh twenty-five tons. Such density gives it an enormous gravitational pull, which makes it an especially advantageous sun for the testing of the Einstein shift. With the aid of the great Mt. Wilson telescope Dr. Adams has made photographs which show the displacement of the lines corresponding to this great density, according to Einstein's predictions.

Dr. St. John explained also how he learned of the Martian drought by means of the spectroscope mounted on the great 100-inch telescope, the largest instrument of its kind in the world. He stated that if Mars has any inhabitants, they must be able to get along on about one twentieth of the water one finds on the tops of the semi-desert mountains in southern California.

When light passes through a substance, certain colors are absorbed, and what these colors are can be learned by means of the spectroscope. Specifically, light passing through water vapor of a certain density will always be absorbed in the same way. By catching the light from the planet with the great reflector and analyzing it with the spectroscope, Dr. St. John was able to determine the amount of moisture in the Martian atmosphere.

There was a possible source of error in the absorbing effect of water vapor in the earth's own atmosphere. This was corrected by taking spectrographic pictures of the sky. When the absorbing effect shown in these was subtracted from the total in the plates from the planet, the remainder represented the absorption in the atmosphere on Mars. This proved to be only five per cent. as great as the absorption of the very dry atmosphere above the summit of Mt. Wilson, indicating that the surface of Mars must be highly arid.

Measured by the same method, the amount of oxygen on the neighboring planet also is relatively very low; according to Dr. St. John, it is only 60 per cent. as great as the oxygen supply on Mt. Everest, where exploring expeditions have had to resort to the use of oxygen tanks in order to keep alive.

Though deficient in water and oxygen, there is no doubt that Mars still possesses an atmosphere. E. C. Slipher, of the Lowell Observatory at Flagstaff, Arizona, showed that photographs made with red-light filters made the planet appear larger and showed greater detail than those made with blue-light filters. Red light is known to have greater powers of penetration through the atmosphere than blue; so that the photographs would tend to indicate the presence of an atmosphere on Mars.

Mars is more thrifty than the earth of the radiation it receives from the sun, according to Dr. C. O. Lampland, who, using the Coblentz radiometer, found that though Mars receives less energy from the sun it absorbs all but 15 per cent. of what it receives, whereas the earth reflects nearly half of the light and heat falling on it. The temperature of Mars, Dr. Lampland concludes, may not be greatly different from that of the earth. Dr. Lampland has also studied the planet Mercury with the radiometer, but finds Venus unapproachable because of its dense envelope of presumably cloudy atmosphere.

Dr. Otto Struve, of Yerkes Observatory, brought the question "What is that distant sun, known to astronomers as Kappa Draconis, doing with its hydrogen?" before his colleagues. He has not found the answer yet himself; all he has discovered is that at times this inconspicuous member of the stellar universe seems to have plenty of the lightest of the elements, and after the lapse of a number of years that the hydrogen is gone again.

In 1890 Dr. E. C. Pickering, then the director of the Harvard College Observatory, discovered bright lines in the hydrogen region of this star's spectrum. Making a study of the photographic records filed at Yerkes Observatory, Dr. Struve has discovered that these lines grew fainter and fainter, until they disappeared completely in 1904. They reappeared in 1911, became brighter until 1919, and have remained steady since that time. Now Dr. Struve expects them to weaken and disappear once more. But he has no explanation to hazard for such erratic behavior on the part of a distant sun. Dr. Struve also discussed and described the clouds of calcium, the element responsible for lime, marble, chalk and a number of other familiar things, but which blown out to atomic fineness and fiery heat, wander in stellar space.

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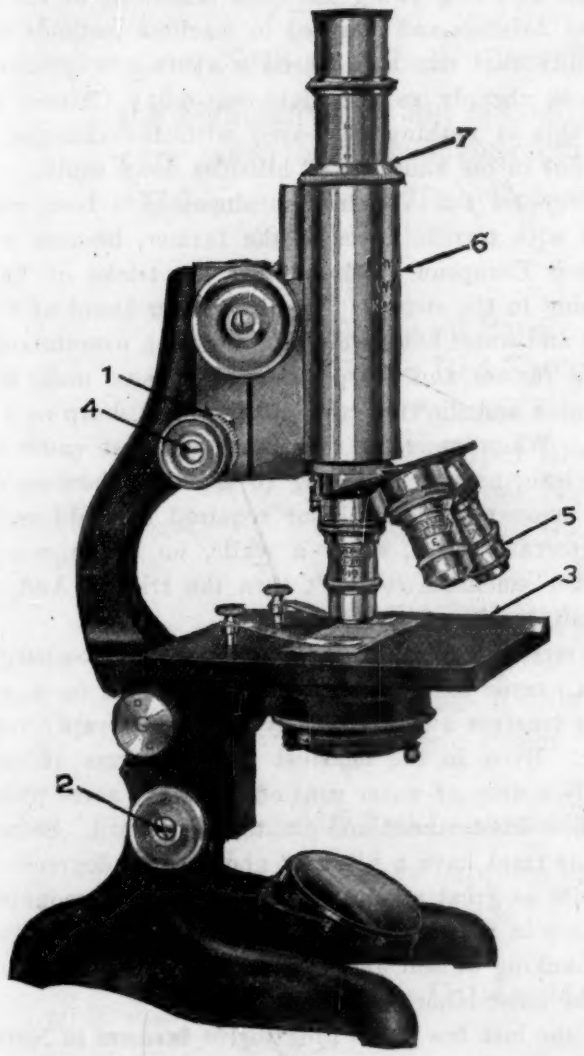

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In some places double stars, pairs of twin suns, rotate about each other in the midst of such an eddying celestial limelight. His attention was first drawn to the existence of these calcium clouds because certain lines from double stars did not shift when photographed through the spectroscopic telescope, as they should have if the light emanated from the twin suns of a double star, as they alternately advance and retreat. Further observations led him to the conclusion that these lines were due to the element calcium, which formed a sort of envelope of glowing stellar mist about the whole of the double solar systems. Further search of the heavens discovered other calcium clouds without any stars in them; such masses lie mostly along the line of the milky way.—*James Stokley.*

THE BREEDING HABITS OF THE SALMON

SOME of the secrets of how and why the salmon, year after year, finds its way to its spawning ground by navigating a maze of forking rivers have been discovered by Professor Henry B. Ward, of the University of Illinois.

No single factor is adequate to explain all the activities of an aquatic animal; but some have greater influence than others. In an intensive study of the fresh-water life of the Pacific salmon, he discovered that temperature plays a large part in the salmon's life.

The life history of the Pacific salmon may be divided readily into three chapters: first the early life of the young fish in fresh water; second, the period of growth in the ocean, and third, the wandering of the adult through fresh water to the spawning grounds, in which the reproductive process is invariably terminated by death.

The red or sockeye salmon follows a definite course in its migration, moving steadily up-stream against the current. This positive response to the current stimulus is not adequate to explain its action at two points, first at stream junctions and second in selecting a precise place to spawn. When the red salmon reaches a fork in the stream, it does not necessarily select the larger, the clearer, the deeper or the swifter branch, but in an extensive series of observations I have found that it always selects the colder water. The determining influence appears to be the relative temperature of the two branches rather than the absolute temperature of either. If both branches should have the same temperature, some other factor would determine the choice, and it may be that such a factor might in special cases overrule the temperature stimulus. But no such cases have been observed. In testing this stimulus, observations must be made at the exact time when the fish are moving up the stream.

The red salmon regularly spawn in a lake, and in all cases observed it selected that part of the lake margin where an inflow of seepage water was demonstrated. At such points the water is distinctly colder than elsewhere along the shore. During the winter, however, these areas would be warmer and the water would be protected from freezing. In the exceptional cases when the red salmon does not spawn in a lake, it still deposits its eggs in spring-fed areas. This response to the temperature stimulus is of fundamental importance since it protects the eggs against the destruction which would be inevitable if they were actually frozen.

The movements of aquatic animals are directed by influences which are partly internal and partly external or environmental. Even though the latter be complex, careful and continued observation will serve to show what influences are most significant in directing and controlling the activities of a particular species. Confusion easily results from applying to one form conclusions reached in the study of other species.

MOUNTAIN AGRICULTURE

AMERICAN mechanical genius is beginning to revolutionize mountain agriculture. In the last twenty years the art of rice-growing has been taken out of the hands of the Asiatics and adapted to machine methods so successfully that our high-priced workers now produce the crop as cheaply as the eight-cent-a-day Chinese coolie. But this is nothing compared with the changes being wrought in the handling of hillsides down south.

For years the Appalachian slopes have been washing away with terrific losses to the farmer, because men of western European stock applied the tricks of flat-land farming to the steeps. They had never heard of the terraces and water holes which the Corsican mountaineer, the Javan farmer and the persistent Japanese make to hold the rains and the rich earth on slopes as sharp as a house roof. When news of these methods first came to the American, he was unwilling to use them because of the vast amount of heavy labor required to build such dirt architecture. But, after a while, he began wondering whether machines couldn't turn the trick. And, surely enough, machines would.

A retired engineer, Lawrence Lee, of Leesburg, Virginia, seems to have been the first to hit on a way of using tractors and a specially designed scraper for such work. Even in the heaviest thunderstorms of summer, hardly a drop of water runs off the sixty acres which Mr. Lee now has terraced and planted as orchard. Some parts of this tract have a pitch of about forty degrees—which is quite as great as most of the remarkable mountainside terraces in the Philippines and Java, where for centuries the banking of soil and care of crops have all been done by the most laborious of handwork.

In the last few years progressive farmers in North and South Carolina have adopted this new technique. Especially in the badly eroded stretches along the Catawba River, thousands of acres have been delivered from the ravages of the rains. Applied to the millions of acres in Appalachia which are being washed away, this method will conserve many hundred million dollars' worth of top soil; and it will convert what is now an unprofitable wilderness into a rich empire. Land worth nothing to-day can, in a few seasons, be transformed into forage crop acreage worth at least thirty dollars per acre; and, after ten or fifteen years of tree planting along the terrace ridges, this same land, as had already been demonstrated in Virginia, yields a return that makes it worth from seventy-five to two hundred dollars per acre.

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Professor J. Russell Smith, the economic geographer at Columbia University, has made a special study of the Old World terrace methods and of these new American ways. He has found rough mountainsides in Corsica yielding nut crops as heavily as Illinois bottom lands yield corn. He states that a new dividend-paying country about the size of France will be added to the United States as soon as the Appalachian region adopts generally the tractor-built terraces of the Lee type and develops fast-growing hardwood trees to plant on the land.

That oaks, walnuts and hickories can grow much faster than the common run of them now do is quite as certain as the improvements which have been wrought in corn, wheat, apples and many other crops. Were it possible to increase, by selective breeding, the rate of wood growth by only twenty or twenty-five per cent., this would eventually add many millions of dollars to our national wealth.—*Walter B. Pitken.*

TRANSPARENT STEEL

THE new method of making sheets of metal of unprecedented thinness, invented by Dr. Karl Mueller, of the Physical Technical Institute of Berlin, seems likely to prove of considerable industrial as well as scientific importance. He has succeeded in producing sheets of steel so thin that they are as transparent as the clearest glass. The test plates used to determine the transparency of optical glass, and ruled with lines one twenty-five hundredth of an inch apart, were photographed through such a metal sheet, and when enlarged to four hundred diameters the scale lines showed distinctly without any distortion. This absence of aberration proves that the structure of the film is perfectly even and equal in all directions. The metal sheets are so thin that atoms will pass through them without impediment. Alpha rays from radium, that consist of streams of the stripped atoms of helium, and are completely blocked by a sheet of paper, are not perceptibly weakened in passing through such metal sheets. It is calculated from the specific gravity of the metal that in these sheets there are not more than thirty layers of atoms in thickness. Yet the sheet of metal is so strong that when fastened in a frame it may be bent out by blowing on it to a sixteenth of an inch without rupture.

Dr. Mueller makes these sheets by depositing an extremely fine film of the metal on a smooth surface by means of the electric current and afterwards separating the film from the foundation on which it was fixed.

Many applications have already been made by scientists and inventors to secure these transparent metal sheets for experimental purposes. They seem likely to serve as semi-permeable membranes for the separation of gases. They may greatly advance the progress of telephotography and television. They also seem likely to prove serviceable in metallurgical research, and in the making of galvanometers, radio receivers and apparatus for measuring the action of the heart.

SODIUM HYPOCHLORITE

THAT sodium hypochlorite, the common disinfectant used in drinking water and swimming pools, does not sterilize by direct contact, but by means of germ-destroying invisible rays which it gives off when it comes into contact with organic matter, is the conclusion drawn from experiments made by French chemists, M. Philippe Bunau-Varilla and M. Emile Techoueyre, and communicated to the Academy of Sciences by M. Jean Perrin, professor of physical chemistry at the Sorbonne.

It used to be thought that the purifying power of the compound was due to chemical reaction, as it oxidized organic matter and decomposed itself. But while M. Bunau-Varilla was trying to determine the smallest amount of sodium hypochlorite necessary to sterilize a given amount of drinking water and not leave the usual chlorine taste, he found that the quantity necessary was too small to enter into any appreciable chemical reaction, and this fact suggested his ultra-violet ray theory.

A series of experiments was then devised to prove or disprove the theory. A tube of quartz, which, unlike glass, is transparent to ultra-violet rays, was filled with a dilute solution of sodium hypochlorite and placed within a larger tube of quartz. The interspace was filled with water contaminated with colon bacilli, and the combination immersed in a bath of hypochlorite solution. An identical arrangement of quartz tubes, but lacking the surrounding disinfectant, was prepared and the sets were allowed to stand twenty-four hours.

In order to find out if the hypochlorite had really given off death-dealing radiations, drops of the contaminated water were taken out of both tubes and "planted" in dishes of gelatin—a sort of bacterial dinner pail—where they were allowed to grow. The solution containing the most bacteria would grow the largest number of "colonies," and *vice versa.* In 51 times out of 60 the contaminated water that had been surrounded for 24 hours by the hypochlorite solution grew fewer bacterial colonies than water not so exposed.

It appears from these experiments that the hypochlorite gives off ultra-violet rays which, passing through the quartz, destroy the microbes that they reach.

ITEMS

EARLY Egypt was populated, about 13,000 B. C., by kinsmen of the cave-dwellers of Europe, according to Sir Flinders Petrie, foremost archeologist. He discovered beneath the oldest known previous habitation site a still older settlement, with flint instruments similar to those of European stone age culture known as Solutrean. An ivory statuette links Egypt with Asia at an exceedingly early date. Pottery, finer and thinner than any subsequently made in ancient Egypt, was also found. The culture thus marked has been named the "Badarian," from the place of its discovery, near Asyut. Its antiquity was determined by a study of the record of the floods of the Nile. The early civilization of Britain was connected with that of the Egypt of Tut-ankh-amen's day by Sir W. Boyd Dawkins, who discovered buried at the famous and mysterious Stonehenge a number of Egyptian beads dating from the reign of Tut-ankh-amen's predecessor and father-in-law, Akhnaton, in 1360 B. C. This is the first clue to the date of these magelithic monuments, which have long been one of the great archeological riddles of the world.

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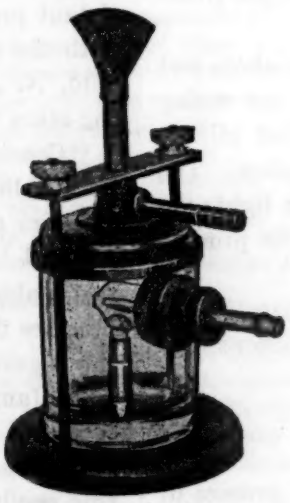

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SCIENCE NEWS

Science Service, Washington, D. C.

SUNLIGHT AND VITAMIN "D" IN EGGS

"Eggs from sunkist hens—Keep the kids' legs straight." Such or similar may soon be the type of advertisements we shall see in the market place. Whether or not an egg contains vitamin "D," the substance that prevents "weak legs" in chickens and rickets in children, depends on the kind of life the hen that laid it has led. If she has been an out-of-doors hen, getting plenty of sun baths, or even if she has been getting daily doses of ultra-violet light from quartz mercury vapor lamps, she will produce vitamin "D" eggs. But if she has lived a sheltered life in a glass house, her eggs will be of no use to prevent rickets.

Experiments conducted under the direction of J. S. Hughes, professor of chemistry at the Kansas State Agricultural College, give evidence for these conclusions.

An egg a day was included in a ration deficient only in vitamin "D" which was fed to forty-eight chicks divided into lots of a dozen each. Chicks fed on eggs laid by hens that had received both sunlight and artificial ultra-violet light grew up thrifty fowls without any indication of weak legs.

Eight of the twelve chicks whose diet included an egg a day from hens which had been kept in a room lighted only by glass windows but which received ultra-violet light treatment one half hour daily developed mild cases of rickets. They were able to stand but had weak legs.

A third pen of chicks got eggs from hens which had received plenty of sunlight, but no ultra-violet light treatments. These chicks were thrifty.

All the chicks in the fourth pen contracted rickets and four of the lot died. Their diet included an egg a day from hens which received no direct sunlight but all the sunlight that penetrated a large south glass window. The glass in the window filtered out the ultra-violet light, the part of the sun's rays that is responsible for the production of vitamin "D" in the egg.

Vitamin "D" is stored in the yolk of the egg, it was shown by a supplementary experiment with chickens conducted by the department of chemistry.

SMELTER ELIMINATION

A process eliminating the smelter from the process of changing iron ore into steel and employing the direct reduction process of iron ore to iron without smelting has succeeded in American laboratories, is now in use by a company at Oviedo, Spain, and is being perfected at the University of Minnesota Mines Experiment Station with a view to its introduction at the northern Minnesota mines.

Low-grade ore, containing 30 to 45 per cent. iron, and low-grade fuel, such as North Dakota lignite, can be used in the process, according to specialists at the Minnesota station. Large savings will be effected, first, by using the cheap fuel, and, second, by eliminating the shipment of the large percentage of waste matter that must be moved as part of low-grade iron ore.

The ore is placed in one end of a long, rotating tube and the fuel, in gasified form, is forced into the other. A temperature of 1,800 degrees Fahrenheit is maintained and air is excluded. The fuel burns by combination with the oxygen of the ore. When combustion has been completed only silica remains as a foreign substance, mixed with the metallic iron, and the iron is separated from the silica by magnetism or some other physical process. The temperature at which this takes place is not sufficient to melt the ore, and it is unchanged in structure when taken out, although its color has changed from red to black. The metallic iron is then agglomerated into briquets by pressing, so that it will be easier to handle.

It is claimed that perfection of the process on a commercial scale will provide the most important method yet developed of utilizing the low-grade ore of the Minnesota and Michigan ranges, estimated to exceed 1,000,000,000 tons, of which almost none is now used in the iron and steel industry.

SETTING A WATCH BY THE STARS

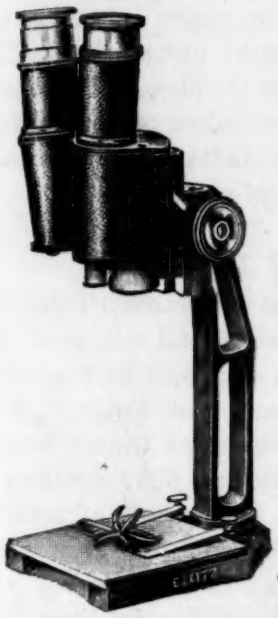
If you are out of doors on a clear night, and your watch has stopped, you can set it to an accuracy of within 15 minutes of the correct time by looking at the northern sky. Of course, the astronomer always finds his time by stellar observations, but this gives him star or sidereal time, and complicated tables are necessary to change this to the solar time which is in common use. By a method recently developed by Dr. Charles C. Wylie, assistant professor of astronomy at the University of Iowa, with the cooperation of Dr. W. W. Merrymon, of Bloomfield, N. J., approximate solar time may be found from the stars with relative ease.

"Consider the northern sky as a huge clock face," says Dr. Wylie, "with the Polar Star at the center and the pointers of the Dipper as the hour hand. The numeral six will be directly below the Pole Star and twelve directly above. Then read the indicated time. With a little practice this can be done to the nearest quarter hour. To this figure add the number of months that have elapsed since January first, to the nearest quarter month; double this, and subtract the result from sixteen and a quarter. If the result is more than sixteen and a quarter, subtract this result from forty and a quarter. This answer is the time in hours P. M."

As an example, take an evening late in September. The pointers are in the position of a clock hour hand at seven o'clock. Eight and three quarters months have elapsed since New Year's day, which is added to seven, making fifteen and three quarters. Doubled, this is thirty-one and a half, which, subtracted from forty and a quarter, gives eight and three quarters, or 8.45 P. M. This is solar time and, of course, does not take daylight saving time into consideration.

WORLD CULTURE 5000 YEARS AGO

That the East and the West met as long as 5,000 years ago and that a fairly identical culture extended at the



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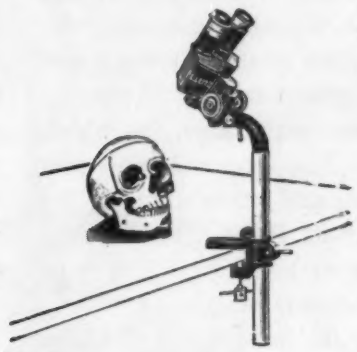

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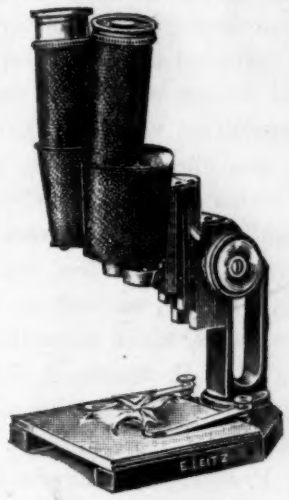

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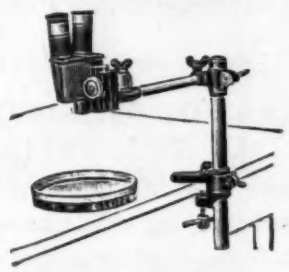

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end of the stone age from Sicily in the Mediterranean through Egypt, Greece, Mesopotamia, Southern Russia and China as far as the Pacific coast is the claim of the Swedish archeologist, Professor J. Gunnar Anderson, who recently returned to Stockholm after serving eleven years as official mining adviser to the government of China.

In cooperation with the Chinese authorities, for which he has the highest praise, he has explored the prehistoric cities of northern China, and after dividing his finds equally with the University of Peking, he has sent home during the past few years no less than 2,200 cases containing fossils, as well as contents of graves, chiefly pottery articles, which show that the inhabitants of China about 3,000 B. C. practiced virtually the same arts as did the peoples living in southeastern Europe and southwestern Asia.

Until Professor Anderson began his excavations the easternmost point at which traces of this common European-Asiatic culture had been found was at Anau in Russian Turkestan, but now they have been located within thirty miles of the Pacific coast in China as well as in southern Manchuria.

It was in 1914 that Professor Anderson obtained leave from the University of Stockholm to become adviser to the Chinese government, and from 1915 to 1919 he was occupied chiefly with technical geologic work in locating mineral deposits. At the same time he observed the opportunity for archeological explorations and in 1918 he obtained the necessary permits. Part of the expenses, amounting to more than $100,000, have been paid by the Swedish government and part by a Swedish-China Committee of which the Crown Prince of Sweden is chairman.

INCREASE OF THE INDIAN POPULATION OF THE UNITED STATES

CONTRARY to widely circulated reports that the "American Indian is dying off at an alarming rate in the great southwest," the Pueblos and other Indian populations are holding their own and increasing at a rate nearly as high as that shown by census figures for the white population.

Dr. Edgar L. Hewett, director of the School for American Research of the Archeological Institute of America at Santa Fé, New Mexico, has transmitted to the American Association for the Advancement of Science a report of a census just made that shows that in the last decade the population of Pueblo villages has increased 22.2 per cent. and now totals to 10,565. Only one Pueblo showed a decrease, and that was due to an influenza epidemic a few years ago.

During the same period the entire population of the United States increased 39 per cent., part of which was due to immigration. These figures Dr. Hewett considers adequate refutation of the general idea that there has been a "startling decrease in our primitive population."

"On the question of the Indian ceremonies, also, much emotion has been wasted," Dr. Hewett said. "They are vital in the life of the Indians. They are highly esthetic in character, and are not attended by as immoral consequences as are the social dances of the whites. Nor are the ceremonies dying out, nor are they likely to. On the contrary, ceremonies that had disappeared are being revived every year and the Indians are preserving their own self-respect by cherishing their native culture which has in it elements of nobility worthy of any race. There is no religious persecution of the Pueblos, no effort is being made to suppress their dances unless pernicious features crop out, and in such cases the Indians are more amenable to advice than are the youth of our own race."

SHADOW BANDS

THE cause of the shadow bands, elusive ripples of light seen just before and just after a total eclipse of the sun, and which were particularly apparent at the eclipse of last January in New York and New England, the path of the next such eclipse visible in the United States, and the results of a New York electric light company in determining the southern limit of the path of totality last January; these were some of the subjects discussed by the members of the American Astronomical Society who met recently at Carleton College. Dr. Charles Clayton Wylie, of the Iowa State University, announced the results of his study of the shadow bands and, in his opinion, they are due to irregularities in the atmosphere. "If the light from a bright star, such as Sirius, is allowed to fall on a white surface in an otherwise dark room," said Dr. Wylie, "a person of keen eyesight may see a pattern of light and dark mottlings, because the source of the light is a point. Ordinarily in sunlight these mottlings are not seen, because the patterns overlap, but at the time of an eclipse, just before and just after the moon covers the sun, a narrow sliver of light remains, which is practically a line, and so the overlapping is in one direction only and the effect may resemble the stripes in a flag."

In confirmation of his ideas, Dr. Wylie quoted results of observers at the January and other eclipses, which showed that the shadow bands are usually parallel to the direction of this narrow edge of the sun. At New Haven, Conn., Poughkeepsie, N. Y., and other points along the path of the eclipse last winter, the bands were seen for many minutes before and after totality. They resembled the pattern seen on the bottom of a sunlit pool at first, and moved with the winds, but as less of the sun was seen they became more like stripes. This effect is supposed by Dr. Wylie to have been due to an unusually disturbed condition of the atmosphere over the cities, as a result of the warm air from chimneys.

The next total solar eclipse will be in Sumatra next January and already astronomers from Swarthmore College, the U. S. Naval Observatory and the Mt. Wilson Observatory have sailed to observe it, but before many years have elapsed people in the northeastern part of the United States will again have an opportunity of witnessing this rare phenomenon. On the thirty-first of August, 1932, a total eclipse will occur and pass through parts of Vermont, New Hampshire and Maine. This eclipse will start near the north pole, and the path of totality will enter the country in northern Vermont, and will leave across the Atlantic Ocean between Portland, Maine, and Portsmouth, N. H. As this will occur about half past three in the

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afternoon, the chances for clear weather should be fairly good.

The sun is evidently not slowing up in its period of rotation, as some astronomers have supposed, even though a series of observations made with the spectroscope of the outer layer, the chromosphere, reveal a slower speed in 1919 than in 1906. This was discussed by Dr. Charles E. St. John, of the Mt. Wilson Observatory. Dr. St. John believes that this is due to the fact that the material around sun spots rotates in different directions at different times. Once every eleven years the spots become very numerous, and then become scarce again, but it has been found by Dr. George E. Hale, former director of the Mt. Wilson Observatory, that in each period the spots behave differently from what they did before. In one period, the westerly spots, for they appear in pairs, are always electrically positive in the northern hemisphere of the sun and negative in the southern, while eleven years later this is reversed. As this also affects the direction of the whirling of the sun's surface, for the spots are really solar whirlwinds, Dr. St. John believes that it might account for the different speeds which have been found, but it will be necessary to study them for two more cycles, or twenty-two years, before the problem is definitely settled!—*James Stokley.*

WHAT MAKES WATER FLOW UPHILL?

STATE a paradox and people will stop and stare. Repeat it a thousand times and nobody will pay any attention.

The ascent of sap in plants is so commonplace an occurrence that we seldom stop to consider what a truly amazing thing it is. Here is an apparent contradiction of the law of gravitation, going on all about us all the time. On every summer day, in every field and woodlot, water flows uphill, whether only a fraction of an inch in the humble mosses or a couple of hundred feet in a towering tree. A single full grown maple or linden will evaporate from its leaves as much as a barrel of water in a single day, and this must of course be replaced by sap flowing up the trunk. The water sent into the air by all the plants combined, must be comparable in quantity with the water carried off by the rivers.

How the water gets uphill in the trunks and stems of trees and plants has long been a sore puzzle to scientists. Several theories have been proposed; none of them is very satisfactory. Until recently the one most commonly favored was known as the theory of "capillarity," which assumed that the water rose in a stem much as oil rises in a wick, through the natural tendency of liquids to climb up in narrow tubes and crevices. The trouble was, however, that ordinarily capillary attraction could not raise water high enough or fast enough to account for all the losses through evaporation and use within the plant. Then there was another theory that took into account a supposed pumping action by the roots, or a so-called "root pressure." This theory, however, was always very vague, and even those who claimed to understand it could not explain it very convincingly.

A comparatively recent development is a theory that seems to explain the phenomenon and at the same time to be free from the objections that have overthrown the earlier ideas. This theory is largely the outcome of experiments by a British scientist, Professor Dixon. He found that by sealing a column of water in a glass tube and using appropriate experimental means, he could make the water carry a considerable weight without breaking. Ordinarily, of course, we think of a stream of water as a thing as unstable as a rope of sand, but the trick seems to lie in getting rid of all the air; for when this was done the water column could support a strain of several hundreds of pounds per square inch.

This is exactly the condition we find in the stems of plants. The fine fibers of which all stems are largely made up are really exceedingly slender tubes, in which water is carried as sap, but from which all air is excluded. These tubes are connected with each other from the ends of the remotest roots to the edges of the topmost leaves. It is thus possible to think of the evaporation from the leaves setting up a strain or pull on the water in the tubes, which is transmitted as through a system of slender silver wires, drawing the water up as rapidly as it is needed, and even reaching out into the soil in contact with the roots and obtaining a fresh supply from outside.—*Frank Thone.*

ITEMS

DISCOVERY that a small snail causes the root-rot disease, which has almost wrecked the sugar-growing industry of Louisiana, is announced by Dr. E. W. Brandes, plant pathologist of the U. S. Department of Agriculture. Hitherto the mollusks, to which order the snails belong, have remained unconvicted as crop criminals. Dr. R. D. Rands, of the Office of Sugar Plant Investigation, however, found that *Zonitoides arboreus,* a snail so tiny that it easily travels through the tunnels made by earthworms, attacks the cane roots. As many as 150 of these little snails have been counted about the roots of a single plant. In their attack they leave minute cavities which are invaded by microorganisms from the soil. These latter complete the injury and often kill the plant. It is estimated that there is a reduction in crop tonnage of at least twenty per cent. directly traceable to the subterranean attack made by these snails whose sweet tooth is literally cutting off the Louisiana cane industry at the roots.

THAT exposure to the ultra-violet rays first increases and then destroys the potency of insulin is the report of Drs. M. M. Ellis and E. B. Newton, of the University of Missouri, to appear in a forthcoming issue of *The American Journal of Physiology.* An accepted grade of commercial insulin was exposed to the action of ultra-violet rays from a powerful mercury vapor lamp for periods of time up to forty-eight hours. The insulin was exposed in an atmosphere of nitrogen in order to eliminate free oxygen and ozone, for it has been shown that insulin is destroyed by oxidation. It was found that exposures for more than four hours destroyed the power of insulin to reduce the sugar content of the blood and the longer exposures even produced an opposite reaction, increasing the sugar content. On the other hand, exposures of less than four hours seemed to increase the potency of the insulin, adding to its power to reduce the concentration of blood sugar.

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SCIENCE NEWS

Science Service, Washington, D. C.

A NEW SOURCE OF HELIUM

A NEW way of getting helium has been suggested in Germany by Dr. Kurt Peters, of the Physical-Technical Institute of Berlin. It is to be distilled from radioactive minerals used in various industries, and mainly from monazite sand, which is made into Welsbach mantels. Although it has been known for a long time that these minerals give off helium when heated, the gas has never been recovered commercially. Dr. Peters claims that it is the largest source of helium in Germany at the present time. He estimates that a production of from fifteen to twenty thousand cubic feet is available annually, which is a thousandth as much as was lost in the Shenandoah disaster in one day.

While this amount will not be sufficient for use in dirigibles it is expected to suffice for technical purposes. Helium has been most difficult to obtain because the United States, which is the only country in the world producing the rare gas in large quantities, has stringent export laws prohibiting its sale to foreign countries except with the sanction of the War and Navy Departments.

Dr. Meissner, also of the Physical-Technical Institute in Berlin, obtained about 25 cubic feet of the gas from a neon-helium mixture. This was obtained as a by-product in the manufacture of liquid air used in Berlin refrigeration plants, after months of distillation in the laboratory. It is estimated that this amount of helium came from about five million cubic feet of air. The new method, according to Dr. Peters, of recovery from minerals instead of from air will yield greater quantities and purer helium.

APPARATUS FOR THE ELECTRICAL MEASUREMENT OF ALTITUDE

A NEW instrument which measures altitude electrically, and about eight times as accurately as the ordinary barometer, to a height of at least one mile, has been constructed by the French physicists, Drs. Huguenard, Magnan and Planiol, and was recently shown before the French Academy of Sciences. The apparatus is based on the fact that a heated object cools off much more quickly in dense air than in very thin air or near-vacuum, because in a near-vacuum there is very little matter to conduct or convey the heat away. The density of air depends on the altitude, so that an instrument that will measure air density will also give a measure of the altitude.

The device consists of a wire of great resistance, so that when an electric current is passed through a high temperature can be obtained. Heat is immediately lost by radiation, convection currents in the air and to a certain extent by conduction. After each of these leaks has done what it can, the temperature of the wire has reached equilibrium; and when once this balance is attained, changes in the temperature of the wire will be due to changes in the density of the surrounding air.

When the wire is made of a metal whose specific heat is known, the measure of its resistance to an electrical current can be used to determine how hot it should get; and from that the density of the surrounding atmosphere can be deduced. It is a well-known fact that the electrical resistance of the wire itself changes with the temperature. A variation in the density of the air will therefore cause a variation in the intensity of the electric current; and this fluctuation can be used to measure the altitude, since the density varies according to the distance above sea level.

BROOKS'S COMET

BROOKS'S comet, one of the seven periodic comets expected to visit the region of the earth this summer, has been discovered by a Russian astronomer named Tscherny, at the University of Kiev, according to a cablegram from the International Bureau of Astronomical Telegrams at Copenhagen. When observed on September 19 it was in the constellation of Aquarius, which is now directly south at about 9:00 P. M. Its right ascension was 23 hours and 18 minutes and its declination 5 degrees and 13 seconds south of the equator.

Cloudy weather has so far kept astronomers at the Naval Observatory from observing Brooks's comet, but on the first clear night the big 26-inch telescope will be turned on the celestial visitor. As the comet is of the ninth magnitude, it should not be difficult to observe with this instrument, which is one of the largest in the country.

Brooks's comet is a periodic one, returning to the earth once in approximately seven years, and its observed position is within 5 degrees of the position which has been computed for it in advance, a little more than the distance between the two pointers in the Great Dipper. Since it was last observed, in 1918, it came close to the planet Jupiter, and its orbit was shortened by Jupiter's gravitational attraction, bringing it back several months sooner than it would have done otherwise. As it approaches nearer to the earth it will become brighter, but it is doubtful whether it will become visible to the unaided eye.

THE FEAR OF LIGHTNING

FEAR of lightning is far out of proportion to the grounds for it, according to a survey made by Dr. Arthur W. Gilbert, Massachusetts Commissioner of Agriculture. This survey showed that the chance of death by lightning is only one in more than a million.

For example, during a five-year period in Massachusetts only 19 persons were killed by lightning, an average of 3.8 persons a year. This is only one ten thousandth of one per cent. of the state's population. It figures out one chance in 1,013,770 of a person being killed in the Bay State by a bolt from the clouds.

The survey indicated that the man on the farm is ten and a half times as likely to be struck by lightning as his

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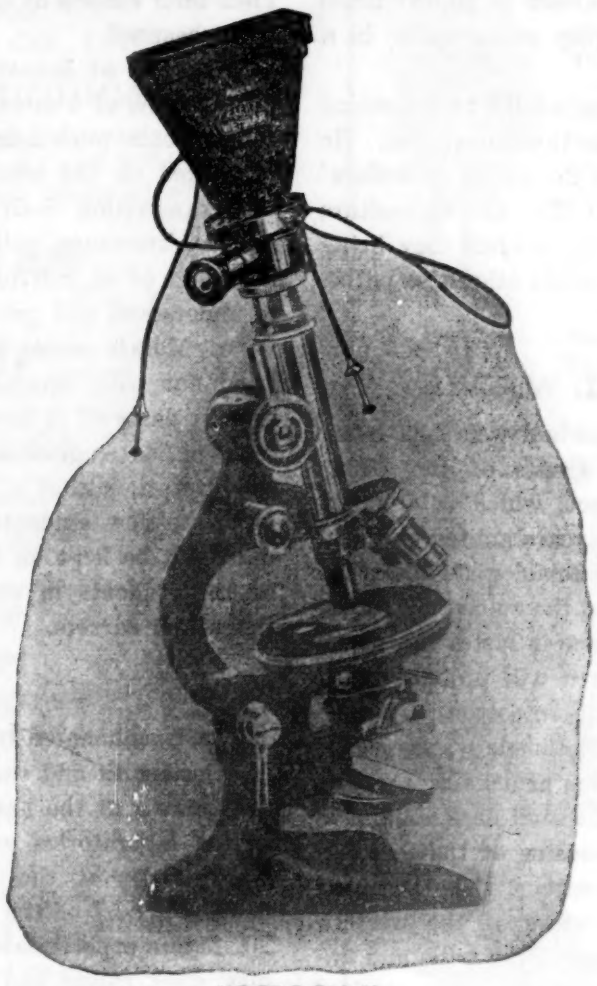

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city brother, due to the scarcity in rural communities of steel-framed buildings, trolley wires, etc., that in the city relieve much electrical tension while a thunder storm is gathering. But Dr. Gilbert assures the farmer that if he is in a house properly equipped with lightning rods during a storm he is in no greater danger than the city fellow. On the other hand, the farmer is 20,000 times safer from harm than a man dodging motor traffic in a large city.

Dr. Gilbert's survey was made primarily to determine the extent of the damage to crops by thunder storms. He found that while these storms cause thousands of dollars' worth of damage to crops at times they aid agriculture much more than they harm it. The rainfall they bring saves large areas of products that would otherwise perish from lack of moisture.

THE WESTERN BOLL WEEVIL

A WESTERN relative of the cotton-boll weevil is being watched apprehensively by field agents of the U. S. Bureau of Entomology. This insect, which is a hardy pioneer type of boll weevil, has for years hunted the wild cotton of Arizona for food. But entomologists fear that sooner or later it will find its way to the cultivated cotton fields of Arizona and Texas, and once it tastes the succulent squares of the cultivated plant it will probably turn into as terrible a glutton as the southern cotton pest.

J. L. Webb, of the Bureau of Entomology, says that the Southwest has so far escaped the attacks of the boll weevil because the southern type of weevil does not thrive in an arid climate. The western cousins of the southern weevil, however, are used to dry weather. The accepted theory is that years ago the ancestors of the western weevils wandered away from the rest of the tribe and migrated to Arizona. There some sturdy specimens survived and established a new line of boll weevil with habits adapted to the western country.

These weevils live in more or less isolated regions, Mr. Webb points out. But in one or two instances in the past year specimens have been taken from cultivated cotton in Arizona, and government agents are now working on an investigation of the insect's habits and its population statistics so as to be prepared to combat it in event of emergency.

A TEST OF SOCIAL INTELLIGENCE

A TEST of social intelligence is being tried on a group of 1,200 students entering George Washington University this autumn. When the results are in the professors will have evidence as to which students are good mixers, which are quick to size up situations and people, and which are likely to get along in positions where they must direct other people.

"It is a well-known fact that many students who rate high in general intelligence tests do not make good in later life," said Dr. Fred A. Moss, associate professor of psychology at the university, and author of the social intelligence test. "Some of these make fine school records, but they lack what is popularly called the ability to 'get along in the world.' Since universities are trying to bring out the possibilities in their students and to start them off in some direction where they are likely to have success, we believe that a measure of each new student's social sense will provide valuable data." The new type of test deals with practical conditions. The ability of the students to remember names and faces is first tested. Then their success at sizing up a series of social situations was measured.

As a test of keenness at reading faces, a number of photographs of a screen star were thrown on a screen and the students were asked to tell what emotion was being registered on the actor's face. Still another branch of the examination dealt with general information on art, science, literature, politics and sports, because the wider the range of an individual's interests the more likely he is to understand and get along with his fellows.

Dr. Moss's social intelligence test has already been tried out with several thousand cases. He states that certain parts of it have been used in selection of policemen in Los Angeles and in New York state, but this is the first time that a university has attempted to catalogue its new students from the social angle. The test data will be kept on file and compared with the records of the students in university activities and possibly in their later careers.

ITEMS

THE time-honored tradition that hard water is not good for the health and that soft water is has received severe questioning at the hands of Dr. John T. Myers, working in the laboratories of the department of Hygiene and Bacteriology of the University of Chicago and in the medical school of the University of Nebraska at Omaha. Dr. Myers experimented with white mice, white rats, rabbits, dogs, calves and other animals, giving part of each set hard water and part distilled water to drink, but keeping them on similar diets otherwise. In the case of the mice and rats, no difference in rate of growth was noticed; all other animals grew and throve better on hard water than on soft. "Artificial" hard water was used in some instances, with controlled amounts of mineral salts. When this water was no harder than the natural hard waters, the results were indistinguishable. When the artificial hard water was made ten times harder, the rate of growth of the experimental animals was slowed down, but not to a point below the growth-rate in animals kept on a distilled-water ration.

THE long-reaching shoots of twining plants in their movements to obtain a better grasp or a better place in the sun are almost human. This is revealed in a motion picture made by Dr. Frances Long and Vladimir Ulehla, of the Carnegie Institution's Desert Laboratory at Tucson. It speeds up the motions of a twining plant, like the common morning-glory, 19,200 times when thrown on the screen, and demonstrates that this plant has characteristics of movement similar in many respects to muscular contraction. So slow are the movements of vines and other such plants that the average person considers them quite inactive, but Dr. Long's researches show that plants are just as mobile in their way as animals.

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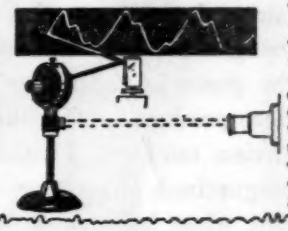

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SCIENCE NEWS

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NORTHERN LIGHTS

THE mystery of the green color of the northern lights and the problem of the Heaviside layer, believed to make long distance radio broadcasting possible, may have been solved as the result of a series of researches just completed by Dr. J. C. McLennan, professor of physics of the University of Toronto, and described by him to the Royal Society of London. From this work it seems that the upper atmosphere, at a height of sixty miles or more, consists largely of helium, the gas used to float dirigibles, even though at the earth's surface the air contains only a minute fraction of a per cent. of this useful gas.

A number of years ago the English physicist, Sir William Crookes, produced what are called cathode rays by passing a high-voltage electric discharge through a tube from which the air had been exhausted. These are now known to be rapidly moving electrons, the minute electrical charges of which the atoms of matter consist. As some of these phenomena appear very much like the aurora borealis, it was suggested that cathode rays were being emitted by the sun and that when these encountered the gases in the upper atmosphere of the earth, auroras were produced. In confirmation of this theory, a Scandinavian scientist, Professor Kristian Birkeland, placed a magnetized sphere representing the earth in a vacuum, and when he bombarded it with cathode rays artificial auroras appeared.

But while the aurora could be partly reproduced in the laboratory, there was one effect that could not be duplicated. If a photograph is made of the northern lights, or even of the northern night sky, with a spectroscope, which analyzes the light into various colors, a prominent green line appears, along with a number of others. Professor L. Vegard, a French scientist, worked on the problem of its origin in Leyden, Holland, at the laboratory of Professor Kamerlingh Onnes, one of the two places in the world where extensive low temperature research is carried on. He found that many of the colors of the aurora were due to the action of the cathode rays on nitrogen; and finally, in the spring of 1924, he announced that he had obtained the green line artificially by freezing nitrogen to a solid, with a temperature of 346 degrees below zero, Fahrenheit, and subjecting it to the action of the rays.

At first this seemed conclusive, but Professor McLennan, director of the physical laboratory at Toronto, the only other laboratory in the world possessing such equipment for low temperature investigations, repeated it, with the assistance of Dr. G. M. Shrum. He found the green color, but as he used a more powerful spectroscope than had Vegard, also found that it did not agree with the line in the aurora. The line in the spectrum obtained from the solid nitrogen turned out to be double, with one part on one side, and the other on the other side, of the green line in the aurora spectrum.

In his latest work, Dr. McLennan has been able to reproduce the line artificially, in precisely the same place as it occurs in the natural aurora. As helium is so light, he supposed that the atmosphere at an altitude of 60 miles would contain a large proportion of it, so he passed the cathode rays through a partly exhausted tube containing about 25 parts of helium to one of oxygen. The line was obtained, even though the use of oxygen or helium alone did not show it. Thus, the origin of all the observed colors in the northern lights are known, and even more important evidence is obtained as to the composition of the upper atmosphere. The Heaviside layer, supposed to consist of ionized gases which reflect radio waves back to the earth, instead of going out in space to be wasted, may consist largely of helium, and the northern lights study may lead to a better understanding of one of the greatest mysteries of radio.

THE USE OF RADIUM IN THE TREATMENT OF LEPROSY

THE successful use of radium in the treatment of leprosy which, it is hoped, will result in the abolishment of the law of segregation that is imposed on those suffering from the dread disease, is reported by Drs. M. H. Neil and R. P. Sandidge, of the Kalihi Leper Receiving Hospital at Honolulu. So far as can be discovered, this is the first use of radium in the treatment of leprosy.

Following a series of experiments, the surgeons announce that in all cases treated with radium, "the leprous nodules disappeared. It is hoped that, by the use of radium, many lepers may be converted from dangerous carriers, emitting millions of bacilli from their noses, to persons not dangerous to public health and thus no longer in need of segregation."

Experiments with the radium treatment for leprosy have extended over a period of six months, the study being concentrated on the use of the element with especial reference to treatment of leprous lesions of the nose.

Seven cases having nodules in the nose were treated by the insertion of a 50-milligram tube in either nostril, alternating at intervals of from two to three weeks, exposure to the treatment being from one and a half to two and a half hours.

In all cases the nodules disappeared, it is said. In three of the cases the bacteria disappeared from the area under treatment. Other similar cases, not receiving the radium treatment, showed no change in nasal condition.

"It is the intent to extend the scope of this work to determine the permanence of its effects and the effect of clearing up the nose on the patient's general condition."

PEARLS FROM THE OHIO MOUND

PEARLS from the Ohio mound hoards show that the ancient Indians who built them and accumulated the jewels found in them were as fastidious as modern jewelers about their quality, according to Dr. Walter Hough, of the U. S. National Museum. They used only

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perfectly shaped pearls, rejecting even the baroque that receive at least minor favor from Europeans.

The Ohio finds, though unusually fine, even sensational in their quality, are not the first discoveries of pearls in the Indian mounds of that region, Dr. Hough said. Some years ago an expedition under the late Dr. F. W. Putnam, of the Peabody Museum of Harvard University, worked on mounds near the Miami and Muskingum rivers in Ohio, and found great quantities of pearls, nearly a peck of them in all. Unfortunately, they had been buried in acid soil, which had roughened and discolored their surface. If the surface layers were peeled off the nacre underneath shone with an exceedingly beautiful but evanescent luster, like the "peeled" pearls of modern jewelers' practice. Pearls, Dr. Hough explained, are chemically quite similar to limestone, and unable to withstand even the weak acids of the soil. Cleopatra's famous stunt of dissolving a pearl in vinegar can be repeated by any one willing to stand the expense. Fortunately, the pearls recently found were buried in a limy, alkaline soil and have not been spoiled. Dr. Hough recalled also a store of pearls found by an expedition under William C. Mills, which had been perfectly preserved by burial in ashes. Included in this find was one necklace of an estimated value of $150,000.

The source of the pearls is obvious enough. The mussels or "clams" abundant throughout the Mississippi Valley frequently contain pearls, which are sometimes of great value. The mound-builders were mussel-eaters, and must therefore have found many pearls, which became part of their tribal hoards. There is small likelihood that any of them came from the sea, for though the mounds sometimes contain sea-shells obtained in barter from more southern tribes there is no indication that sea-pearls were thus obtained.

The tools used by the ancient Indians were primitive, but their basic technique was surprisingly like that of modern jewelers. Some of the pearls were bored for stringing by means of a fine stone splinter, but most of them by means of a slender stick and a little sand and water.

Pearls were also used as eyes in the carved stone ceremonial pipes that have been found in the mounds. These pipes are more frequently carved in the form of birds, but represent other animals also, and usually with the greatest realism and faithfulness of detail.

The copper ceremonial masks, Dr. Hough stated, were probably made by hammering sheet copper into shape over a wooden base or mould. They are all grotesque, and some of them are representations of animals. Some deer masks have been found, with branching horns that project well above the head.

Dr. Hough said that there is no question but that the mound-builders were Indians, so far as can be determined from a study of their skulls. About five or six years ago, however, there were discovered in some of the old mounds intrusive burials of another people, whose remains are still a riddle to anthropologists. These invaders possessed bone harpoons, weapons unknown to the Indians; moreover, in one place a jade ax was found, and the Indians never used jade. These remains strongly hint at a high-northern, Eskimo-like invasion; but no study of their skulls has yet been made, so that nothing positive has been determined.

THE OPIUM TRAFFIC

THE appalling swiftness with which international traffic in narcotic drugs has grown during and since the World War is told by John Palmer Gavit, former New York newspaper editor. Figures gathered by the opium advisory committee of the League of Nations show that narcotic drugs are manufactured in quantities ten times as great as even the most generous estimates of legitimate medical and scientific needs allow, he says.

The evil is not now an exotic affair of the Far East, for, although the eating, drinking and smoking of raw opium are injurious enough, these are surpassed by the present-day use of derivative drugs in concentrated form. These are compact, easily disguised and much more profitable to smuggle, especially with the push of Western criminal genius behind the traffic.

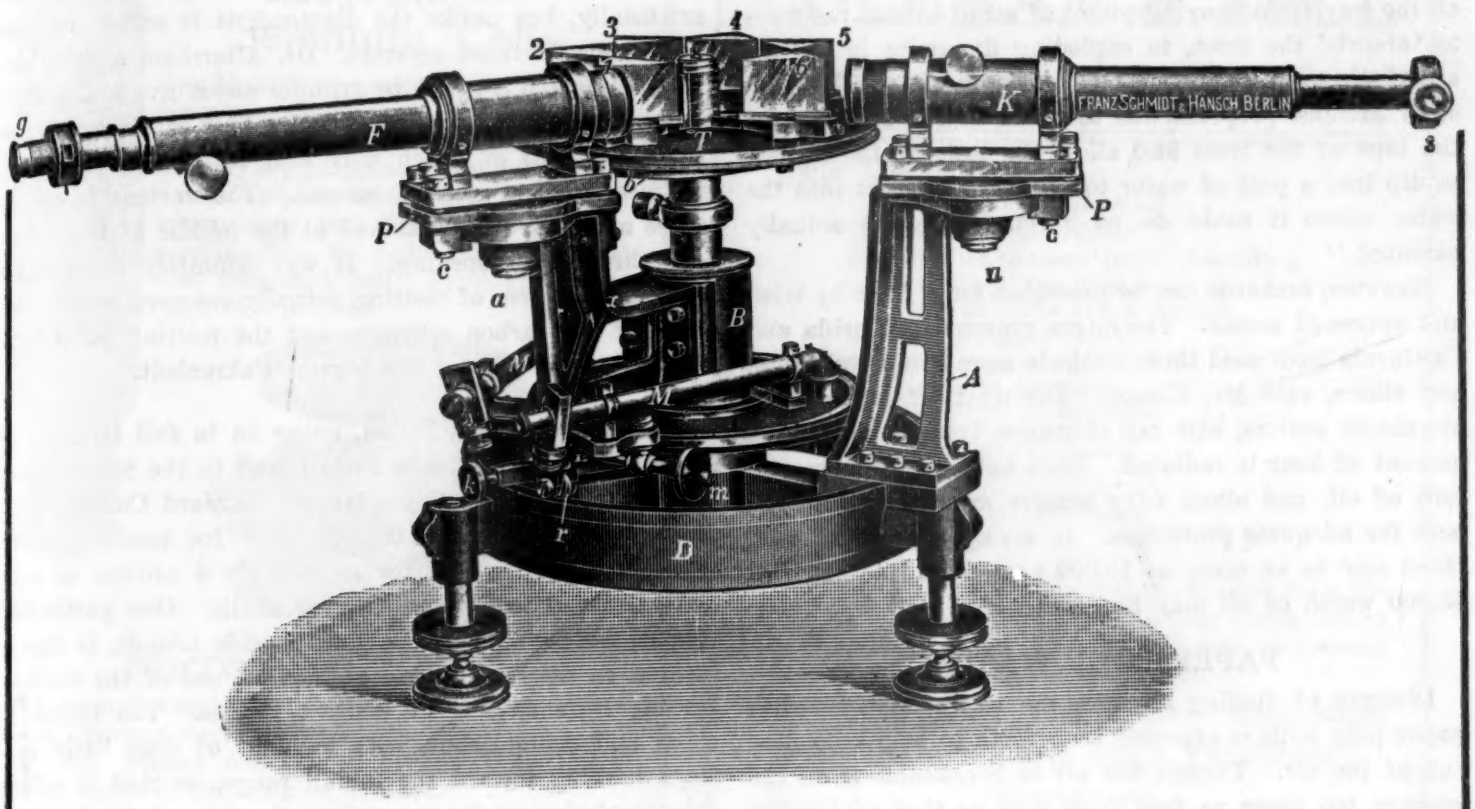
The opium advisory council of the League of Nations estimated the amount of opium and crude cocaine needed for medical and scientific purposes by the part of the world's population that is within reach of such service. Four hundred and fifty milligrams of raw opium and seven milligrams of cocaine is allotted for each person. It is estimated that 744,000,000 people of an assumed world population of 1,747,000,000 are within reach of medical service; therefore the legitimate world need for drugs is estimated as follows: opium, 100 tons; morphine, 136 tons; codeine, 84 tons, and heroin, 15 tons, making a total of 335 tons of narcotics.

Allowing 450 milligrams of opium to every man, woman and child in the entire world, regardless of needs, would require a total of 786 tons annually. "No one knows how much is actually produced," says Mr. Gavit, "but conservative estimates converge with remarkable closeness to 8,600 tons a year, including the 5,000 tons attributed to China. Since the most generous estimate of world needs calls for only 786 tons, less than one tenth of it could possibly find legitimate use."

If the opium advisory committee of the League of Nations were given powers, Mr. Gavit believes it could ration supplies among the nations, and the production of manufactured narcotics could be controlled at the factories. With the cooperation of the various governments the trade could be very well patrolled, for the factories are few and the governments know where to find them.

SCRAP IRON AND DYNAMITE SUGGESTED FOR FROST PROTECTION

WITH the coming of late fall, and the approach of colder weather, fruit growers in different parts of the country are beginning to take elaborate precautions to protect their orchards from the ravages of Jack Frost, but not all the suggestions that have been made to the Weather Bureau, at Washington, will be used. According to J. B. Kincer, chief of the Department of Agricultural Meteorology, a great many of the suggestions that enthusiastic inventors send in are wildly impractical.



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"The 'crank' proposals," says Mr. Kincer, "range all the way from hanging pieces of scrap iron in the trees to 'absorb' the frost, to exploding dynamite in the air above the trees to break it up before it can 'fall.' Another extreme proposal was to throw cotton strings over the tops of the trees and allow the ends of the strings to dip into a pail of water to conduct the frost into the water where it could do no harm. This was actually patented."

However, orchards can be protected from frost by tried and approved means. The citrus growers in Florida and California have used these methods more extensively than any others, said Mr. Kincer. The most efficient devices are the oil heaters, with tall chimneys, from which a large amount of heat is radiated. Each holds about nine gallons of oil, and about fifty heaters are required to the acre for adequate protection. In a single grove, he said, there may be as many as 10,000 heaters and as much as $3,000 worth of oil may be burned on a bad night.

PAPER-MILL WASTE

INSTEAD of fouling streams, the waste from Swedish paper pulp mills is expected henceforth to help keep dust out of the air. Though the air in Stockholm is on the average ten times as free from dust as that of London in a heavy fog, for instance, a campaign has been started to make it as nearly dust-free as possible, and in this a valuable ally has been found in the sulphite lye which the pulp mills of Sweden have hitherto poured away as worthless waste. This summer all the macadamized or unpaved roadways and streets in Stockholm have been sprayed with the lye, to which lime water has been added to make it less soluble in rain. The city authorities of Malmoe and other places have also begun to buy the sulphite lye by the car load to use it on the roads, and a separate company has been formed to exploit the new dust-binding material.

The measurements of dust particles in the air have been made by the meteorologists and the Swedish Government's official meteorologist, Professor Andres K. Angstrom, has calculated that on the average the air in Stockholm contains 4,000 dust particles per cubic centimeter, while in London the usual figure is 10,000 and in heavy "pea soup" fogs runs up to 50,000. The number of dust particles inhaled each minute by a person walking through a London winter fog has thus been estimated at 450,000,000.

ITEMS

THE long-sought-after process of melting carbon, whose lack has stood in the way of the manufacture of genuine diamonds, has been discovered by a group of German chemists, Drs. Alterthum, Fehse and Pirani. Carbon has been one of the most heat-resistant substances known, and for that reason it has been used in arc lights and carbon filament lamps where a powerful current sent through this substance found such resistance that it raised it to white heat without melting. But the existence of diamonds which are pure crystallized carbon tantalized chemists for years, because it proved that at some time in the past carbon had been in a molten state before it formed the transparent eight-faced diamond crystal. Graphite has been known for a long time and can be made artificially, but unlike the diamond, it is softer, opaque and forms six-faced crystals. Dr. Alterthum and his coworkers heated a graphite cylinder about five and a half inches in length and an inch and a half in diameter, the thickened ends of which were sent in copper electrodes, by means of an electric current. The various temperatures attained were measured at the middle of the cylinder through an opening. It was definitely determined that some degree of melting actually occurred within the bore of the carbon cylinder, and the melting point was determined as about 6,300 degrees Fahrenheit.

THE process of evolution, going on in full swing, has been shown to exist in a little island in the South Seas, by Professor H. E. Crampton, of Barnard College, who has been at work on this problem for nearly twenty years. Appropriately, for so leisurely a process as evolution, the animals studied were snails. One particular genus, wide-spread in the south Pacific islands, is represented on the little island of Moorea, one of the Society group, by a number of distinct species. The island is high and mountainous, with numbers of deep little valleys running toward the inland range, so that it offers plenty of chances for separation of races and the development of their distinctive characters. One of the most constant of specific characters in these snails is the direction of the twist of the shell. A given species will twist to the right or to the left, never both; for a "left-shelled" snail to occur in a "right-shelled" species is as unheard of as a man with his head on backwards. Yet Professor Crampton found "waves" of "left-shelled" snails rising in "right-shelled" species, and *vice versa*, together with other evidences of changing character. Professor Crampton treats his discovery very conservatively, for he says, "While the degree to which real diversities have been brought about does not amount to that of specific distinction, yet the differences actually demonstrated are exactly the same in nature as those by which true species are distinguished." He adds also: "That mutation as a real and a contemporaneous process is proved by the existence of divergent individuals of adult growth.

CARRYING its own private waterfall to run itself by a water turbine, a railway car utilizing a new type of power transmission is attracting the attention of Swedish transportation engineers. The prime motive power consists of an internal combustion motor of the usual type, but instead of using gears or electric transmission, the motor operates a centrifugal pump, which supplies water under pressure to a turbine directly geared to the driving axle. The speed of the car is governed by the height of the artificial "head" of water created by the pump. With a motor of 180 horse power the car has attained a speed of 50 miles per hour. An especial advantage claimed for the new transmission method is freedom from jerks in starting and stopping. Swedish railroads have already ordered the manufacture of four motor railroad cars and one Diesel locomotive equipped with the new hydraulic drive.

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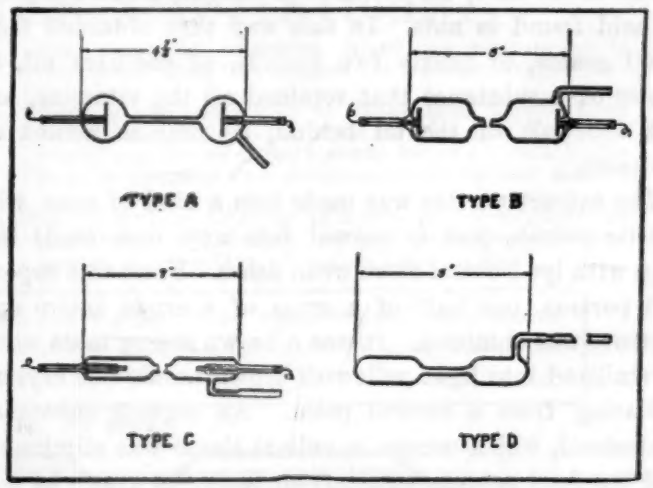

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Science Service, Washington, D. C.

THE CONCENTRATION OF VITAMINS OF COD-LIVER OIL

DRS. HARRY E. DUBIN AND CASIMIR FUNK, biochemists, have at last succeeded in taking the bad taste of cod-liver oil out of the mouth of babes. Until the discovery of vitamins a decade or so ago, no one but grandmother knew why cod-liver oil was so good for childish ailments, and she just knew. When it was found that this vile-tasting oil was the richest known source of two vitamins, one preventing rickets in children and the other warding off a serious eye disease that results in blindness, efforts have been made to develop an extract of it that would be easy to take.

The success of Drs. Dubin and Funk not only does this, but also provides a convenient starting point for the actual chemical isolation and identification of vitamins, becauses it furnishes a purer material several thousand times as strong in vitamin content as the original oil. Laboratory tests on animals and clinical tests on a large number of children, by Drs. Louis Fisher, director of the Infantorium and Nursery of the Hecksher Foundations of New York, have shown that both the antirachitic and antiophthalmic vitamins are retained in the extract.

The problem of making vitamin extracts or of preserving vitamins under artificial conditions has always been a difficult one, because those unknown substances are very easily destroyed. Even the simple cooking of many foods destroys a large part of the vitamin content. The success of Drs. Dubin and Funk was the result of several years' work.

They first made an acid extract of cod-liver oil using either acetic acid, the essence of vinegar, or formic acid, an acid found in ants. In this way they obtained from 2,000 grams, or nearly two pounds, of cod-liver oil, 50 grams of a substance that retained all the vitamins, and left the bulk of the oil behind, as well as almost all the taste.

The extract portion was made into a kind of soap, with caustic potash, just as animal fats were once made into soap with lye leached from wood ashes. From this saponified portion, one half of a gram of a crude active concentrate was obtained. It was a brown sirupy mass which crystallized into light yellowish brown needle-like crystals radiating from a central point. An organic substance, cholesterol, which occurs in animal tissue was eliminated, and the final potent extract from the 2,000 grams of cod-liver oil weighed only one tenth of a gram.

The chemical composition of this substance has not yet been established; the experimenters found that it contains carbon, hydrogen and oxygen, and that sodium, sulphur, phosphorus and chlorine, elements frequently occurring in organic substances, are absent.

LOCAL IMMUNITY

GERMS of diseases that are deadly to an animal or a human being if they find their way into the part of the body they usually afflict, may be entirely harmless if they are planted in another organ or tissue. Doses of anthrax germs a thousand times larger than an ordinary fatal injection have been introduced into the bodies of guinea pigs with no more effect than so much salt water; yet if the slightest trace of the fluid containing them found its way into a scratch on the skin, the animal very quickly died.

These experiments, which promise revolutionary results in the sciences of bacteriology and pathology, are being conducted at the Pasteur Institute, in Paris, by Dr. A. Besredka, a young Russian scientist, according to Dr. Erwin F. Smith, pathologist of the U. S. Department of Agriculture, who recently returned from a tour of inspection through European laboratories.

Dr. Besredka, he says, has discovered an entirely new principle in bacteriology which has been named "local immunity." According to this principle, disease-causing organisms are frequently quite impotent to do harm away from their usual habitat. Anthrax, for example, is always an affliction of the skin and surface tissues. Dr. Besredka devised means for planting cultures of the germs deep in the muscular tissue, in the lungs and elsewhere in the bodies of guinea pigs. Aside from a little inflammation, probably due to the mechanical irritation of the instruments used, the animals showed no signs of harm from the usually deadly organisms. Less serious skin infections, like those caused by staphylococcus, the germ of boils, were shown to act in the same way.

Dr. Besredka's discoveries have already become of practical importance in medicine. After showing that susceptibility to bacterial infection was local, the Russian scientist also showed that immunity could be conferred more effectively by serums and other preventive means if applied equally directly to the regions usually attacked by the disease. Since typhoid fever is a disease of the digestive tract, Paris physicians are now following Dr. Besredka's principle and administering anti-typhoid serum through the mouth rather than by means of injection into the arm. Dr. Besredka claims that when administered in the ordinary way the serum gets no chance to act until the blood has carried it from the muscles of the arm into the intestinal tract.

SOAP AS A GERMICIDE

SOAP has a value as an aid to health even greater and more direct than has hitherto been suspected. The ordinary routine of dishwashing and laundering or cleaning the face and hands is fatal to germs of such dangerous diseases as pneumonia, diphtheria, blood poisoning and other serious infections. Dr. John E. Walker, of the service laboratory of the Army and Navy General Hospital at Hot Springs, Ark., has concluded extensive experiments which showed that common soaps were effective germicides in at least three types of infections, while soap made with coconut oil was markedly destructive to the organisms of typhoid fever.

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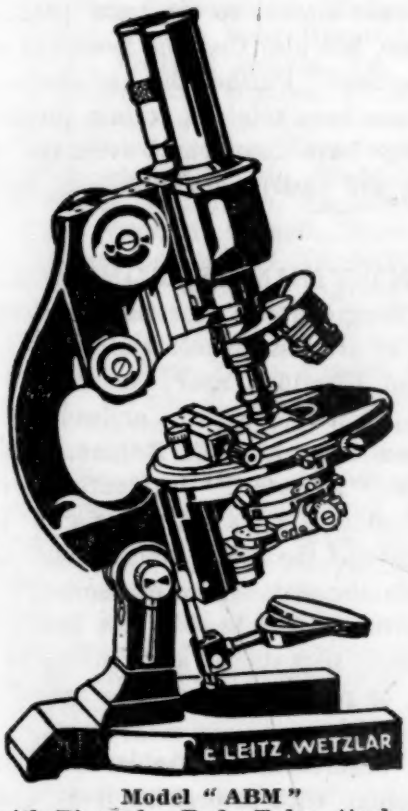

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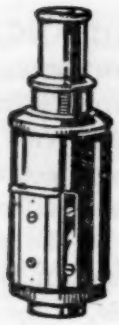

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The soap in greatest use in hospitals is the "official soft soap." The substitution of coconut oil for the linseed oil used in making this soap renders it germicidal against the typhoid bacillus as well as against the other three organisms. Although this change would make the soap more irritating to the skin, it would be desirable, and it would be especially useful in case of typhoid epidemics.

All the soaps tested were more antiseptic at higher temperatures. The organism causing boils, known technically as *Staphylococcus aureus,* completely resisted all soaps, even at a higher temperature, except a sodium resin soap.

Dr. Walker found that when the hands were washed with ordinary care the lather formed contained about eight per cent. of soap. This amount he said was more than enough to kill the pneumonia, diphtheria and streptococcus bacilli. The most careful washing of hands, however, did not kill the staphylococcus or boil-forming organisms, which showed that soaps alone could not be relied upon for complete surgical sterility.

In spite of claims put forth by manufacturers of special soaps, they were found to be no more effective than the average household kind. Foreign substances mixed with the soap often interfered markedly with the germicidal action.

THE SIMILARITY OF CHINESE AND INDIAN LANGUAGES

NEW light has been thrown on the ancestry of the American Indian by Dr. Edward Sapir, the Canadian anthropologist now on the faculty of the University of Chicago. Dr. Sapir said that his research work on Indian linguistics has convinced him of the identity of the language of certain Indian tribes with that of the primitive Chinese.

The similarity of the two tongues and the linguistic distribution of tribes scattered at random over the Americas have convinced Dr. Sapir that these groups must have entered this continent as a wedge from Asia. By a close comparison of the primitive Chinese, Siamese and Tibetian, all in the same language category, with the language of the "Nadine group" of North America, Dr. Sapir has found the same peculiarities of phonetics, vocabulary and grammatical structure on both sides of the Pacific Ocean.

The American Indian groups speaking the language of the Nadine group are found in all parts of the North American continent from northern Mexico to the southern boundary of Alaska, widely distributed among other Indian tribes whose language and customs are entirely different.

With minor changes the Navajo of New Mexico speaks the language of the Sarcee in Alberta, and the linguistic stock of the Tlingit, just south of the Eskimos in Alaska, is much the same as that of the Hupa in California.

It is probable, according to Dr. Sapir, that the migration of Asiatics speaking primitive Chinese or Tibetian took place at some time in the past, and that these immigrants settled or moved over the mountains and plains, some remaining in northwestern Canada to become the Tlingits, and others moving out to the Queen Charlotte Islands off the west coast to form the Haida group, and still others penetrating to the deserts of the Southwest.

From the modern Chinese, which in academic circles is considered relatively simple, students of linguistics can reconstruct primitive Chinese which is far more complex than any of the dialects known to the Mongolian layman of to-day. Dr. Sapir has discovered not only that the Indians of the Nadine groups speak with a tonal accent, raising or lowering of the voice to give certain meaning to words, in a manner similar to the tonal peculiarities of the early Chinese, but also that the meanings of certain words are identical. Further, he has disclosed the fact that the Indians have retained certain prefixes and suffixes that long ago have disappeared from the Chinese speech, but which are clearly discernible in the early forms.

AN ANCIENT VIKING STRONGHOLD

A POWERFUL Viking fortress, the headquarters of a northern chieftain of at least thirteen hundred years ago, was uncovered and identified near the city of Norrkoeping recently by two Swedish archeologists, Dr. Arthur Norden and Colonel N. D. Edlund. Since the name of the place, "Ringstad," is identical with one mentioned in the Icelandic Edda, or collection of historic legends, as the estate of the heroic Helge Hundingsbane, this may have been the seat of one of the mightiest of Vikings. The location at the head of the Bravalla Bay is of obvious strategic importance, and remains of primitive fortifications, or palisades, have been traced in several directions.

What was first unearthed was the stone foundations of an ancient dwelling with several adjuncts, characteristic of the Viking Age. As the structures themselves had been built of wood hardly anything but charcoal remained of them, but on the site of what had formerly been the blacksmith shop, where horses were shod and swords forged, there was found in a good state of preservation a bronze clasp that had evidently been brought to the shop for repairs and had then been lost. An adhering bit of rust indicated that attempts had been made to mend the broken pin with iron. This clasp was easily identified as belonging to the seventh century A. D., but a spear point found on the site of the women's building dated from the third or fourth century, while other objects classified themselves as late as the fourteenth, so that the place had apparently been occupied as a human dwelling for a thousand years. In the course of time it had either been burnt to the ground and had then been forgotten, or the occupants had moved to a stone fortress, Ringstaholm, about three miles farther south.

The stone foundations extend about one hundred and fifty yards in one direction and sixty in the other. Besides the women's house and the blacksmith shop, there are traces of a banquet hall with benches attached to the long side walls, as described in the sagas, and down by the river banks signs of a slaughter house, where barbecues were prepared at Yuletide and when the warriors

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returned from their raids. Of the wooden piles used in fortifications the best preserved remnants were uncovered by the drainage of the river.

EVIDENCE FOR A LAND BARRIER ACROSS THE ATLANTIC

AMERICA and Scotland were formerly joined by a bridge of land, according to evidence discovered by a geological expedition under the leadership of Drs. E. O. Ulrich and C. E. Resser, of the U. S. National Museum, and Professor R. M. Field, of Princeton University, who have just returned to this country with several hundred pounds of selected fossils.

Fossils of trilobites, extinct crab-like animals, found in limestone at Durness, Scotland, were discovered to be exactly similar to those from Northeast Newfoundland and entirely different from those found in Southeast Newfoundland, Wales, Central England, Southern Scandinavia and Central Europe. Comparison of these ancient marine animal remains on both sides of the Atlantic indicates that some sort of land barrier prevented the mixing of animals from the Arctic sea on the north and the Atlantic on the south. This isthmus was evidently narrow, the Arctic and Atlantic animals being found in rocks within one hundred miles of each other at both the American and European ends.

Work has been started on the more detailed study of the fossils in order to determine more accurately the distribution of land and sea during the Cambrian and Silurian epochs of geological time, when the trilobites with corals unlike those found to-day flourished abundantly.

In collecting the specimens, the expedition visited England, Wales, Scotland, Norway, Sweden, Denmark, Germany and Czechoslovakia, and held frequent conferences with leading European geologists in an endeavor to correlate the rock strata of America with similar outcrops in Europe.

THE SCIENTIFIC LIGHTING OF THEATERS

IMPROVEMENT of the "movies" by more scientific lighting of the theaters is urged before the Royal Photographic Society by Dr. K. C. D. Hickman, of the department of chemistry at the Royal College of Science. This does not require more lights, but a better arrangement of the illumination. Chief of his recommendations, which are based on a study of the operation of the human eye, is that instead of surrounding the screen with black velvet or other dark hangings, this area should be fairly bright. The screen itself, however, should not receive any light, other than that from the projector.

The chief trouble with the lighting in the theaters is in contrast. "Only a small portion of the retina—the sensitive lining of the eye—is being used," Dr. Hickman states, "while the outer portion is being kept dark; whereas anywhere else, it would all be subject to the same illumination. It is the field of view embraced by this outer region which determines the sensitiveness of the eye. This increases the contrast and apparent brightness, giving the picture a fictitious strength and brilliancy, and also it induces eye-strain. A collateral effect is the destruction of all sense of blackness, for it is impossible to appreciate as black the shadows in scenes whose darkest parts are brighter than the surroundings in the theater.

The improvements suggested by Dr. Hickman consist in arranging the side lights so that they can not shine on the screen. The region around the screen might be illuminated by making it of light color and projecting light on to it from an extra stereopticon in the booth, using a slide with a central opaque portion, so that none of it would go on the screen. Another method suggested would be to have the screen a short distance from the wall, with lights back of it. In this way the lighting of the theater would be more uniform and the effect would be more that of an actual scene viewed through a window.

ITEMS

THE earthquake which shook Nicaragua and other parts of Central America on Sunday night, October 4, has been traced to southeastern Honduras, according to Commander N. H. Heck, in charge of the earthquake investigations of the U. S. Coast and Geodetic Survey. Commander Heck states that "the epicenter, or point of maximum disturbance, was at 14 degrees 30 minutes north latitude and 85 degrees 30 minutes west longitude, which places it in the Colon Mountains near the Nicaragua-Honduras boundary. The quake occurred at 11 hours 9 minutes and 2 seconds P. M. eastern standard time. We have arrived at this result by means of reports obtained by Science Service from seismographic stations at the Dominion Observatory, Ottawa, Canada; Fordham University, New York; the U. S. Weather Bureau at the University of Chicago, and the Coast and Geodetic Survey's stations at Tucson, Ariz., and Cheltenham, Md. A peculiar feature of the quake was that it was apparently most severe in Managua, Nicaragua, nearly 200 miles from the epicenter, while Tegucigalpa, the capital of Honduras, about a hundred miles distant, seems to have escaped unscathed."

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AGRICULTURAL PRODUCTION AND THE POPULATION OF THE UNITED STATES

IF the people of the United States are willing to endure a slightly changed standard of living, they need have no fear of over-population in the immediate future. But the next century will probably see a decrease in our comforts and luxuries, and our agricultural system before the close of the period will be hard put to keep pace with our growing population.

Dr. O. E. Baker, of the Bureau of Economics, U. S. Department of Agriculture, has made a study of the physical limits to agricultural production and population saturation under different systems of agriculture. His conclusion is "that after our arable land has increased about 100,000,000 acres, which appears likely to happen during the next 75 years, and if our acre yields of the crops attain those in northwestern Europe, and our diet reaches the pre-war German standard, our nation will be able to support about 300,000,000 people." But that these conditions will be fulfilled is very uncertain.

By 2000 A. D., it is estimated, our population will be between 190 and 200 million. How to feed, clothe, house and provide with the amenities of modern life these 80 additional millions of people is a very practical problem which faces the American people, and especially the Department of Agriculture, which is endeavoring to anticipate agricultural conditions during the next few decades.

Of course, farmers now are more concerned with the present surplus of their commodities than with the prospective shortage of agricultural products. But the fact remains that our population is increasing about 1,500,000 every year despite the diminution of immigration; that despite this rapid increase in population, no net extension of the crop area has taken place during the past few years, and that the yields per acre of crops, averaged together, show little or no increase during the past 15 years. The number of farmers and the farm population is decreasing, and there seems to be a slackened demand for land.

It has been possible, however, to have a steady increase for several years in our production of food without any increase in the area of agricultural land or in the yields per acre because a larger proportion of the land has been devoted to crops and less to pasture. More corn and potatoes and wheat and sugar and vegetables have been produced, crops which yield much more food per acre than pasture used for livestock. This movement is expected to continue, and it holds out hope for us. A changed diet, less meat and more vegetable products will enable our farmers to keep pace with the growing population, for several decades at least.

Through extension of the crop area by a third, through increasing the acre-yields of the crops another third, and through this change in diet, which would permit population to increase a third, the United States can provide food supply sufficient for double the present population, which is the population it is likely to have about a century hence. Beyond this point it is probable that both individual welfare and national strength would begin to diminish. But if population then continued to increase until the ratio of cultivated land to population attained that in Japan, our resources could support a population of a billion. However, as Dr. Baker concludes, "Let us hope that this condition of poverty may never be reached. It would weaken rather than strengthen the nation, for strength is measured more by per capita wealth and welfare than by numbers of people."

HOOF AND MOUTH DISEASE IN DENMARK

HOOF and mouth disease of cattle, which caused serious trouble in the Southwest last year and was suppressed only by the most rigorous destruction of the infected herds, is being treated in Denmark, the most important dairy country for its size in the world, by means of a serum prepared from immune animals. Dr. Erwin F. Smith, pathologist of the Bureau of Plant Industry, who recently returned from Europe, tells of the efforts of the little kingdom to rid itself of the disease by veterinary treatment, inasmuch as the destruction of infected herds is out of the question because of the wide prevalence of the malady in Europe.

"I spent some time in Dr. C. O. Jensen's laboratory in Copenhagen, which is the veterinary serum laboratory of the Danish Agricultural College," said Dr. Smith. "I went to see him primarily because in time past he has done important work on the tumors of animals. I found him head over ears in preparing serum for foot and mouth disease, now prevalent in Denmark. We have had several serious outbreaks of this disease in the United States suppressed at great expense by the general government through quarantine and slaughter of the animals. The disease attacks cattle, sheep and hogs, and sometimes men contract the disease from milk or from tending sick animals.

"The mortality of the disease varies, I believe, in different epidemics and in different localities. Dr. Jensen told me that the mortality in Denmark in untreated animals was about 25 per cent. He said that the disease had come into Denmark recently from Germany where, since the war, they have become lax in caring for outbreaks. He told me that they had had 22,000 outbreaks in Denmark and 80,000 in Holland. The disease also occurs in quite a good many places in England and in the Scandinavian Peninsula. He said that the form of the disease in Sweden was so light that it was difficult to get farmers waked up to deal with it.

"I found him preparing serum for this disease on a large scale—a regular United States of America scale. This serum is obtained from animals which have recovered from the disease. They take several gallons of blood from each animal, about one quarter of the blood of the animal, with no serious result, so he said, beyond reduction of

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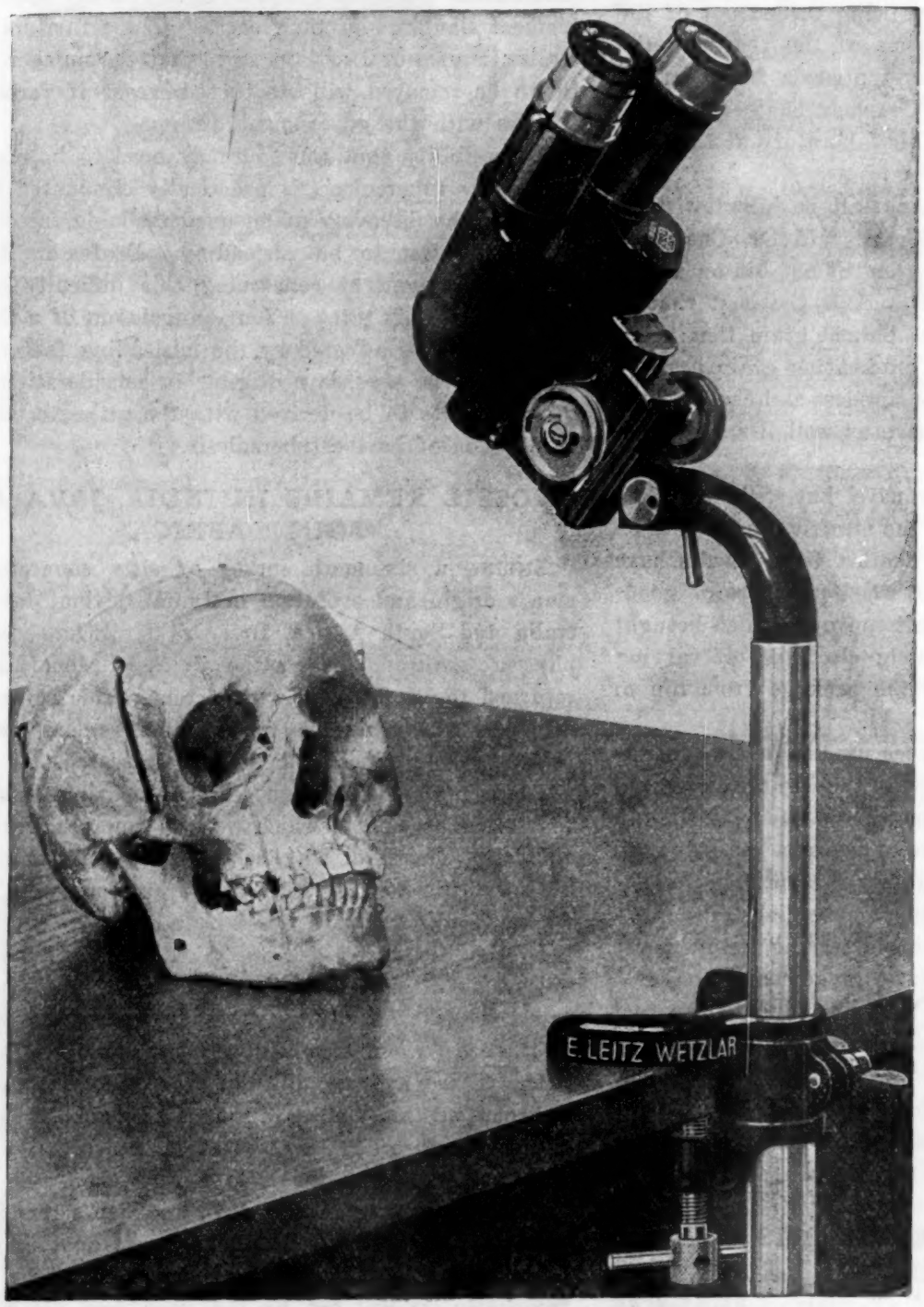

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milk supply for some time. To this blood is added chinol, an antiseptic, and allowed to stand over night. It is then centrifuged, drawn off into large sterile glass containers, and afterwards bottled in sterile bottles to send to the farmers.

INSECTS IN STORED GRAIN

FREEZING, electricity and X-rays may all be called upon to protect from the ravages of insect pests the thousands of wagonloads of corn that are being turned out of the Mississippi cornfields at this time of the year and the loads of wheat that are dotting the roads from Canada to Texas. Professor Royal N. Chapman has been attacking the grain pest problem in his laboratory at the University of Minnesota.

"Weevils in stored grain could all be killed without resorting to chemical insecticides," said Dr. Chapman, "if the grain were merely taken out of one bin on a very cold day and put into another. It is the heat that is maintained in the depth of the binned grain that keeps them alive." This method of eradicating grain pests in storage elevators is not only the simplest and cheapest yet discovered, but the most effective as well, Dr. Chapman believes.

Another method that is very novel but still in the experimental stage is the use of the electric current, which literally shocks the insects to death. Good results have been obtained by Dr. Chapman when packages of goods were passed along an endless belt conveyor which brought them into contact with a series of electrodes at varying levels until the entire area of the package from top to bottom had been treated.

The X-ray method has also been used to destroy insects in packages. Its use in destroying the cigarette worm in tobacco has been known for some time, although its application to the destruction of insect pests in grain is new. However, the method has been only a laboratory process and is still too expensive to apply commercially.

Although Dr. Chapman considers the temperature method the best, he believes that a great deal of research work is still necessary along that line, due to the fact that some insects that infest human food supplies may be frozen without being killed. Probably $200,000,000 worth of harvested grain and packed food products are destroyed annually in the United States by grubs and weevils, he estimates.

BOVINE TUBERCULOSIS

"ERADICATE bovine tuberculosis" is the appeal made by science and government to the farmers of America, according to Professor E. G. Hastings, of Wisconsin University. Tuberculosis in cattle, condemned by science for spreading human tuberculosis and for despoiling the farmer's bank account, has resulted in a nation-wide campaign by state and federal governments, which bids fair to be successful in eradicating bovine tuberculosis.

Professor Hastings, head of the bacteriological department, and Dr. B. A. Beach, of the veterinary department of the University of Wisconsin, conclude from field and laboratory work on the problem that the tuberculin test compares favorably with diagnostic tests for other diseases. Without it, they state, the struggle against bovine tuberculosis would be hopeless. This test, which singles out the diseased animals from the healthy, is based on the fact that injection of an extract of dead tubercle bacteria causes fever in tuberculous cattle. On the basis of this test, diseased cattle are removed from the herd so that they may not spread the disease.

Some farmers, not appreciating the advantages which tuberculosis eradication will bring, naturally oppose government slaughter of their cattle. These farmers should realize, Professor Hastings says, that the number of cattle to be removed will steadily decrease if farmers cooperate with the government agents.

A possibility that the test may need to be continued even after tuberculosis is practically eliminated is indicated by the discovery of an uncontrollable factor which causes the test to be misleading. Professor Hastings gives encouragement concerning this difficulty by suggesting that only three or four animals out of a thousand are likely to be affected by the misleading factor. This number, as he says, is negligible in consideration of the great benefits to be derived with the ultimate objective, eradication of bovine tuberculosis.

FOSSIL REMAINS IN INDIA, JAVA AND SOUTH AFRICA

ENDING a six-month survey of sites connected with man's origin and evolution in India, Ceylon, Java, Australia and South Africa, Dr. Aleš Hrdlička, curator of physical anthropology of the U. S. National Museum, returned to Washington with a remarkable collection of evidence which reveals three great regions as undeveloped "gold mines" for scientific research.

These regions which show such amazing richness in fossil remains and in which work is now practically at a standstill, Dr. Hrdlička declared, are the Siwalik Hills of India, the Solo River valley of Java and the Taungs-Broken Hill country in South Africa.

In the Siwalik Hills, which extend for hundreds of miles from Cashmir nearly to Burma, he found that five or six species of fossil big apes have been discovered, two or three of which have not yet been described by scientists. These ape remains are from different geological horizons in this single range of Himalayan foot-hills, and the surface has hardly been scratched.

In the valley of the Solo River, where the famous *Pithecanthropus erectus* or Java ape-man's remains were discovered in 1891, Dr. Hrdlička found another rich but neglected region. Old and well preserved fossils are still frequently washed out by the river, and natives sometimes find and sell these, but there is no scientist there to collect them. Pithecanthropus could not have existed alone. He must have had predecessors and possibly progeny whose remains may be revealed by a systematic study of the region, Dr. Hrdlička claimed.

Another region offering immense possibilities in throwing light upon the origin of man is at Taungs and in the Broken Hill country of South Africa. Dr. Hrdlička found two skeletons of cave men in this section, where the remains of the mysterious Rhodesian man were originally discovered.

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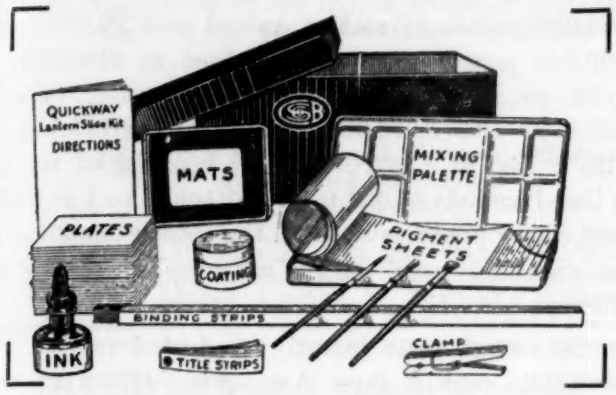

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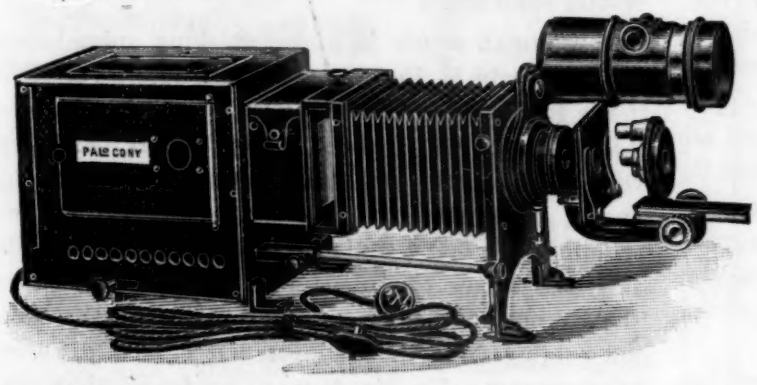

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Besides inspecting these sites of major importance in connection with man's evolution, Dr. Hrdlička travelled extensively in India and Australia and made observations upon the people now living in those countries. In various parts of India he found definite traces of Negrito blood, and was able to trace the route followed by the ancestors of the Negritos of the Philippines in migrations from Africa by way of India.

Among natives of Tibet, he also discovered remarkable American Indian types showing that they were remnants of the same people who populated America.

"I have some photographs of this latter people," said Dr. Hrdlička, " which I would swear were American Indians if I had not taken the pictures myself."

THE SEA'S RADIO BEACON

THE simplest and most constant sound in nature, the washing of the sea, serves as a radio beacon to warn whales, porpoises and many fishes to keep away from shore and below the surface in rough weather, according to Dr. Austin H. Clark, of the U. S. National Museum, and formerly naturalist on the scientific ship *Albatross*. In an interview he explained how modern wireless devices for transmitting danger signals to ships off shore in a fog are rivalled by nature's own method of protecting her creatures.

"Waves breaking on the shore and white caps on the open ocean," he said, "give forth a high-pitched, hissing sound consisting of an infinite number of separate sounds arising from the breaking bubbles which rapidly succeed each other."

Prolonged, uninterrupted sound is intensely disagreeable and soon becomes distressing. We have all noticed this, Dr. Clark pointed out, in the prolonged ringing of an electric bell, in the continuous rumbling of an idle motor engine and in other ways. Being high-pitched, the hissing sound of breaking waves has a marked directive quality; that is, it is easy to locate its point of origin. Being unceasing, it is distressing and repellent, and all the more sensitive sea creatures try to keep away from it. Whales, porpoises and dolphins and many fishes always keep well off shore, Dr. Clark stated, and they are apparently guided by these repellent sounds, while on a windy night various other types of life which normally would come up to the surface stay well beneath it.

"The simple breaking of the waves is of immense importance to sea creatures as an index to the dangers that they run," he concluded. "In times of storm the repellent sound increases and by this they are warned to keep farther from the shore and farther down beneath the surface.

ITEMS

MANY forms of sea food now considered of scant value have great possibilities, and in view of the depletion of supplies of shad, sturgeon, salmon, lobsters, crabs and other forms that are now used, the neglected ones may come into importance, according to Lewis Radcliffe, deputy commissioner of fisheries of the Department of Commerce. "An examination of our fishery statistics reveals the absence of some sea foods and a very small catch of others which reach a considerable magnitude in the fisheries of European countries," he says. "For example, the 1924 landings by fishing vessels in Great Britain include over 6,000,000 pounds of anglers or monk fish, valued at $230,000. Our Atlantic coast fishermen annually throw overboard about 10,000,000 pounds of this fish which has a higher nutritive value than the 'scarce' cod. There were also landed in Great Britain 20,000,000 pounds of cockles, valued at $200,000; nearly 23,000,000 pounds of mussels, valued at $130,000; 77,000,000 pounds of sharks, skates and rays, valued at $3,657,000, and 5,300,000 pounds of periwinkles and whelks valued at $100,000. The aggregate of the products listed exceeds 65,000 tons. Although in many of our waters, these products abound, the volume used for food is comparatively small and is consumed chiefly by those of foreign birth."

INTELLIGENCE tests recently conducted in San Francisco public schools show American children to be superior to Chinese children in the matter of intelligence, says Virginia T. Graham in her report of the tests to appear in *The Journal of Comparative Psychology*. The Chinese children used as subjects for the tests were all pupils of the Oriental School of San Francisco, a public school exclusively for Chinese. Only about one fifth of the children tested were born in China, but all were of Chinese parentage and came from Chinese-speaking homes. The majority were Cantonese. The subjects were all twelve years old and as practically all the twelve-year-old children in the school were tested, the group was reasonably representative. Several different types of standard mental tests were used and in so far as possible tests were selected which would not likely be affected by the difference in language. These same tests had been given previously to a group of American children and the results recorded.

A MUSICAL mouse is the astonishing animal described by Dr. Edwin B. Powers, of the University of Nebraska, in the forthcoming number of the *Journal of Mammalogy*. According to Dr. Powers' story, Dr. H. A. Morgan, a friend of his, was bothered for three or four nights last spring by a singing noise which for a while was attributed to a leaky radiator valve. Curiosity finally getting the better of Dr. Morgan, he began a search for the source of the noise and found that the noise was not coming from the radiator, but from a different part of the room. To his dismay, he found that the noise was coming from a waste paper basket. Upon shaking the basket, a mouse ran out and Dr. Morgan gave chase. The mouse ran into a small room from which there was no escape. As soon as the chase was stopped, the mouse would sit up on its haunches and sing, the singing approximating the noise made by the cricket but much more continuous. For ten or fifteen minutes before the mouse was captured it was in open space and under constant observation; and every time it came to rest this singing would take place, even under the excitement of the chase. The mouse was finally captured, but was fatally injured during the capture and died the next day in spite of efforts to keep it alive for further observation. It was turned over to a naturalist who identified it as the common variety of house mouse.

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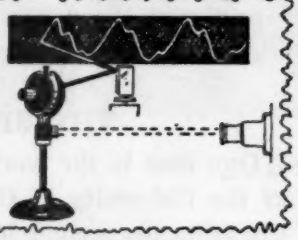

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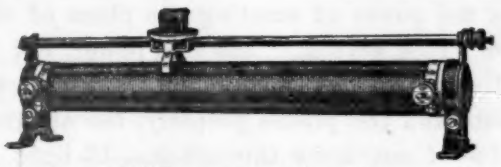

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SCIENCE NEWS

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THE OPTICAL SOCIETY OF AMERICA

ARTIFICIAL sunlight, methods of transmitting photographs by wire, the effects of glaring lights, the names of colors: these are among some of the problems being considered at the meeting of the Optical Society of America which opened its tenth annual convention at Cornell University on October 29. The meeting continued until October 31.

On the first day, Professor E. M. Chamot, of Cornell, told the scientists of his work in applying the microscope to the problems of chemistry, and on Saturday his colleague, Professor Simon H. Gage, will describe the latest improvements in the microscope. Telegraphic transmission of pictures is the subject of Dr. Herbert E. Ives, who is retiring as president of the society. Dr. Ives is connected with the research laboratories of the American Telegraph and Telephone Company, and has been chiefly instrumental in developing the method of transmitting photographs now in use. On Friday evening, Dr. Dayton C. Miller, of the Case School of Applied Science at Cleveland, speaks on "Contributions of optical measurements to physical theory." Dr. Miller has recently repeated experiments made originally by Dr. A. A. Michelson, of the University of Chicago, which have been said by many authorities to overthrow the theory of relativity, and this work will be described.

A method of changing the light from a nitrogen-filled incandescent lamp to the same color as that from the noon-day sun, without the use of dyed filters, colored glass or solutions, or any of the usual devices, was described by Dr. Irwin G. Priest, of the U. S. Bureau of Standards at Washington.

Dr. Priest's apparatus was designed in order to permit "artificial sunlight," important in many industries which require accurate color matching, to be standardized. It depends on the use of polarized light, which is light made to vibrate in one direction, instead of promiscuously, like ordinary light, by what the physicist calls a Nicol prism. If a beam of polarized light is allowed to fall on another such prism parallel to the first, it will pass through. If the two are at right angles, however, the beam will not pass through unless some material is placed between them which has the power of rotating the plane of vibration. Quartz, or "rock crystal," has this power, but does not rotate all colors to the same extent. By arranging the quartz plate and the prisms properly, the apparatus will appear blue if one looks through it. If light from an incandescent lamp is passed through, it will be converted into a light closely resembling daylight. As no actual colors are present in the system used to filter the light, there is nothing to fade, and it can be accurately standardized.

How the vacuum thermocouple, a delicate laboratory device which gives a small electric current when heated, has been used by astronomers to study photographs of stars and their spectra, was explained to members by Dr. Edison Pettit, of the Mt. Wilson Observatory at Pasadena, Calif. In many astronomical problems the dark lines on spectrum photographs reveal many secrets if it is known which lines are most intense. In the new apparatus, the light from an incandescent lamp shines on a narrow slit, parallel to the lines on the photograph, through the photographic plate and then onto the thermocouple. As the plate is moved past the slit by a motor, the intensity of the light falling on the thermocouple varies and the readings of a galvanometer connected to it indicate the relative intensities of the lines.

What shall the various characteristics of colors, interesting alike to the artist and physicist, be called? Heretofore almost everybody who has written on the subject has had his own private system of naming, and in an effort to introduce some uniformity, the Optical Society of America has appointed a committee to study the various systems of names. According to the report of this committee questionnaires were sent to representatives of the three groups of art and art education, industry and research.

"Light" is the term most preferred for the "force by which objects are rendered visible," other suggestions being radiation, radiant energy and luminosity. "Gray" received the most votes for what is commonly called by that name, but "neutral color" and "achromatic colors" found a large number of adherents. "Value" and "brightness" was preferred to designate an arrangement where the samples became lighter.

THE SPEED OF LIGHT

ONE man in the world, Professor Albert A. Michelson, of the University of Chicago, now knows within twenty-five miles per second just what the speed of light is, and he promises that by the end of next summer he will have the figure correct within five miles, or perhaps even one mile, per second. Light travels with an approximate speed of 186,300 miles per second, so that the present figure is correct within approximately one ten thousandth of one per cent. of error, and the promised determination within five miles per second of the exact speed will be correct within three one hundred thousandths of one per cent.

Professor Michelson has been refining his measurements of the velocity of light through further experiments at the Mt. Wilson Observatory in California.

The light measurements were made between Mt. Wilson and Mt. San Antonio, a distance of about twenty-two miles. Professor Michelson projected a powerful light through a narrow slit onto a mirror which was spinning at the rate of about 30,000 revolutions a minute, which in turn projected it on a reflecting apparatus at the far station. The reflector returned the light to the original source. With an accurate knowledge of the rate at which the mirror is revolving and the distance between the two stations, Dr. Michelson found it easy to calculate the ve-

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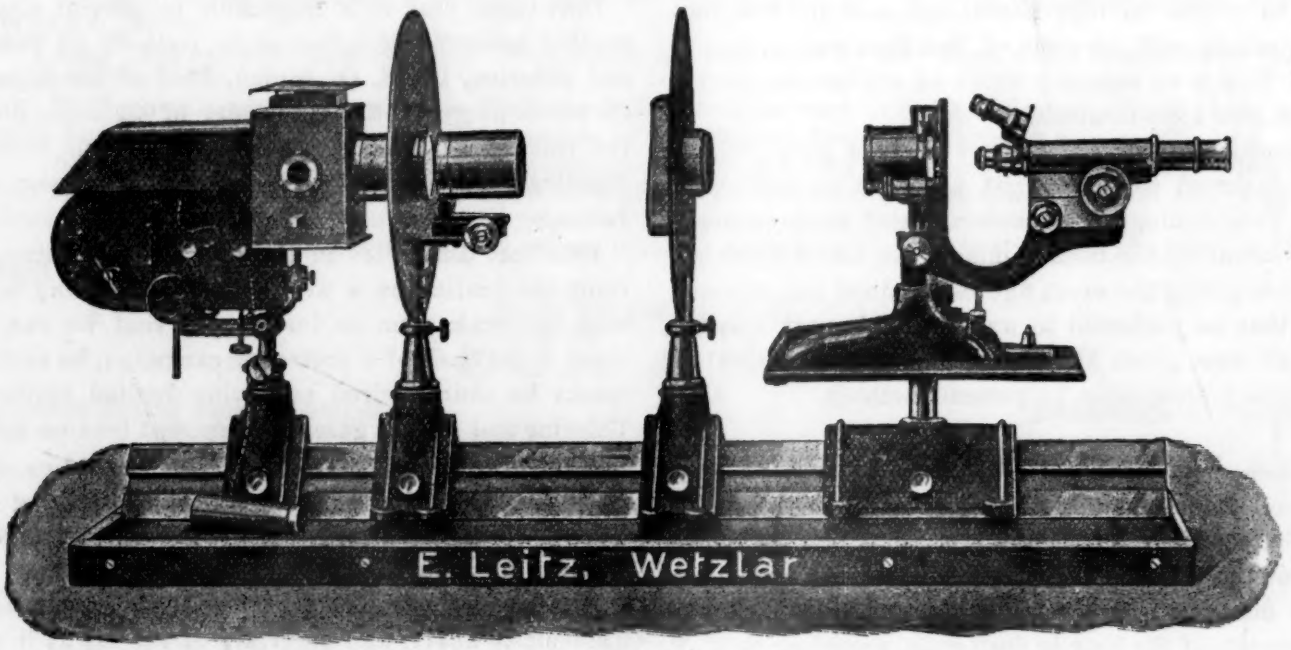

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locity of a ray of light. With the perfection and refinement of the mechanical devices he plans to repeat the experiments in the summer of 1926. He said that he would try to measure the velocity between two stations about 100 miles apart. The present revolving mirror is to be replaced with one which is much larger and capable of projecting three times as much light over a given distance.

Professor Michelson points out that the velocity of light is increasing proportionally with the decrease in the velocity of the earth. With this decrease in the earth's velocity our unit of time measurement is constantly being lengthened, and as the relative length of our second becomes longer so will the velocity of light become faster, he said.

There are practical uses for an accurate figure for the velocity of light. Knowing the velocity, it is perfectly possible to reverse the experiments and measure distances between points with an error of less than one part in a million. This is an accuracy which no engineering instrument can ever hope to attain.

The experiments of the summer of 1924 gave 186,300 miles per second as the nearest approach to the actual figure. This figure, Dr. Michelson stated in announcing it, is accurate within twenty miles. He asked to be excused from giving the exact figures obtained this summer, stating that he preferred to wait until his next season's work shall have given him the nearest approach to absolute accuracy obtainable by present methods.

THE DETECTION OF OIL FIELDS

NEW oil fields and other valuable mineral deposits in regions where the tell-tale rock structures now lie buried far below the surface and random drilling is impractical, may be discovered at a relatively low cost by means of measurements of the heat in deep wells, according to W. T. Thom, Jr., geologist in the division of fuels of the U. S. Geological Survey.

Series of temperature measurements taken at different depths in wells of the Salt Creek dome in Wyoming, he said, show that there is a direct relation between these temperatures and the shape of the folds in the rocks associated with oil deposits. The sharpest rise in temperatures has been found near the crest of the dome and proportionately less sharp increases at various points on its flanks. Similar temperature differences have also been found in artesian wells in eastern North and South Dakota.

These relationships suggest, Mr. Thom said, that they may be used to locate concealed uplifts and buried hills such as control oil production in south-central Oklahoma and California. A single well showing an abnormally sharp rise in a series of measurements at different depths would indicate the existence of an uplift in near-by rock strata. Two wells would give a possible clue as to their relative position on the uplift, and three wells would give a suggestive guide as to the general direction in which the crest of the concealed uplift would lie.

Not only would this in many places reduce the amount of exploratory drilling required to discover oil and gas pools associated with such features, but small holes for temperature measurement could be put down the necessary thousand or more feet with a diamond drill at a much lower cost than for ordinary oil well drilling. Moreover, systematic study of existing holes and artesian wells may lead to the discovery of oil in regions not now seriously considered, and yield enough evidence to justify wildcat testing of the oil possibilities of deeply covered rocks in the Great Plains states.

This method would serve as an effective supplement to other methods now being used but would in no sense supplant them. Mr. Thom's theory is that the rock strata were first folded up; then, in the course of geological time, the top of the fold was cut off by weathering, exposing the deeper-lying and hotter rocks at the crest of the ridge or dome.

INFLUENZA

DECLARING that it is impossible to prevent altogether another epidemic of influenza by methods of quarantine and isolation, Dr. E. O. Jordan, head of the department of bacteriology of the University of Chicago, discussed the efficacy of various preventive measures before the American Public Health Association in session at St. Louis.

Practical difficulties in the way of administering efficient vaccination on a world-wide scale during an influenza outbreak seem so insuperable that we can hardly make it the basis of a protective campaign, he said. Face masks he characterized as having limited applicability. Chlorine and similar gases he dismissed because they have not yet proved of decisive prophylactic value.

Dr. Jordan believes, however, that something can be done to lower the attack rate in favorably situated small groups, to protect some individuals altogether and to lessen the virulence on the part of the accessory microbes. Difficult to apply, and uncertain of success as it may be, the minimizing of contact seems at present to offer the best chance we have of controlling the ravages of influenza.

It is now clear that the first estimates of the loss of life caused by the influenza epidemic of 1918 were too low. The disclosures of the census of British India of 1921 and other data that have since come to hand make an estimate of 20,000,000 deaths in the whole population of the world probably not wide of the mark. This is comparably the worst catastrophe of the sort that has visited the human race since the Black Death of the Middle Ages.

Judging by the past nothing is more certain than that we shall some day have another visitation of this destructive infection. It is not to be doubted that if it were to descend upon us to-morrow we should, as public health workers and students of the disease, be little if at all better equipped to deal with it than we were seven years ago. It is conceivable, however, that if we occasionally remind ourselves of the gaps in our knowledge we shall be in a position to study more advantageously the manifestations of the disease even in the presence of an epidemic period. There are certainly also lines of direct investigation which can be prosecuted to-day with some hope of rendering ourselves better prepared to cope with the next epidemic.

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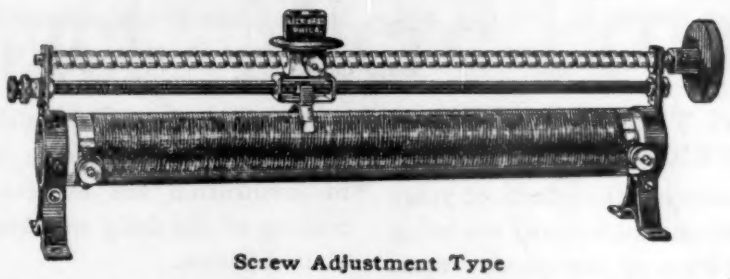

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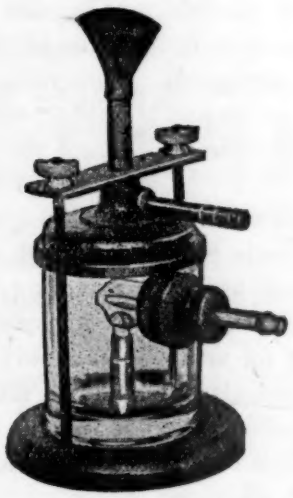

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If the influenza was not a new disease in most parts of the world it certainly was greeted like one and behaved like one, Professor Jordan continued. In many parts of the world the time of importation of the new disease, if it was a new disease, into a region where the so-called endemic influenza had previously prevailed, could be specified to a day. Its introduction into certain army camps in the United States is known to the day and hour.

EXPERIMENTS WITH TUBERCULOSIS VACCINE ON AFRICAN APES

A SERIES of experiments, continuing the efforts of years to find an effective vaccine against tuberculosis, are being carried out in tropical West Africa on the manlike apes. Dr. J. Wilbert, who has announced promising results for the Pasteur Institute, does not, however, venture to say how these may lead to the ultimate goal, anti-tuberculosis vaccination in man.

The experiments carry on the pre-war work of Dr. A. Calmette and C. Guerin, who produced a vaccine of tuberculosis organisms greatly reduced in virulence, which, they have repeatedly claimed, confers immunity without giving the disease. According to Calmette, the only effect of vaccination with this serum is to produce a "general disease like typhoid fever which cures itself spontaneously after fifteen to twenty days without causing the slightest tubercle formation."

Calves, guinea pigs, rabbits and monkeys treated with a small dose of the substance appear to become highly resistant to tuberculosis. The war caused a postponement of his attempt to carry the experiments further by trying the serum on man's nearest biological relation.

Human conditions were reproduced as far as possible in the ape colony. Fifty-nine chimpanzees lived under similar conditions of exposure. Nineteen were vaccinated, twenty were infected with virulent tuberculosis germs and twenty were kept unvaccinated as control animals whereby to judge the rest.

Of the nineteen vaccinated, eleven died of various causes, but never showed any sign of tuberculosis even at death, and the other eight are now in good health. Of the twenty unvaccinated animals kept as controls, nineteen died of tuberculosis and the other of an acute infection of another kind. Of the twenty animals infected with virulent tuberculosis, nineteen died of the disease and the other of intestinal trouble. Thus out of fifty-nine apes, only eight are now alive and all these had been vaccinated.

AN EXPEDITION TO GREENLAND

AN expedition to penetrate into the interior of the great ice sheet covering Greenland and learn the secrets of the weather in that area is being organized this winter by Professor W. H. Hobbs, of the University of Michigan, an authority on glaciers and geology.

Equipped with airplanes for preliminary exploratory work, with radio apparatus adequate to maintain constant communication with the outside world, and with scientific instruments to record meteorological data and observe the movements of the great Greenland glaciers, the party to be headed by Professor Hobbs will start for the far northern Danish island-continent of Greenland in July of next year.

One of its objects will be the establishment of a weather observing station on the great plateau of ice some 150 miles inland, and 6,000 to 7,000 feet above sea level. Never before has this been accomplished. Professor Hobbs plans to maintain an observing staff at this station for a year in order to give to the meteorologists of the world information about the behavior of the weather in that part of the world which seems to be the place where storms either are born or die. The data to be radioed to civilization are expected to aid materially in the making of the daily weather forecasts in Canada and the United States.

The expedition will be under the auspices of the University of Michigan where Dr. Hobbs is professor of geology. Several American governmental bureaus interested in the scientific problems of the arctic have promised active participation in the expedition and the expedition will also cooperate informally with Dr. Lange Koch, leader of the Danish government's scientific party which will take the field at Scoresby Sound on the east coast of Greenland in July, 1926, at about the same time that Professor Hobbs's party is establishing its base nearly directly opposite on the west coast at Holstensborg, just below the arctic circle. Dr. Koch, who has had long training and experience in explorations in Greenland, will trek directly across the continent of Greenland from east to west, making scientific observations during the two months' journey. Previous to this he plans to map and investigate the geological features of the unknown portion of the west Greenland coast.

Regular exploration of the wind currents and temperatures of the upper air will be a feature of the routine observations at the two stations to be established. Large rubber sounding balloons will be used for this purpose. Since the inland station on the ice sheet will be over a mile high above the sea, and the coast station off the edge of the glacial ice will be over a half-mile high, it is expected that the balloons will succeed in probing and revealing the weather secrets of unusually high altitudes.

At least two airplanes with pilots and mechanics will be a part of the expedition and the rest of the party is now in the process of organization. Radio communication on short wave length will be provided between the two stations as well as with the United States.

ITEMS

AN exploration party under the combined auspices of the Tropical Plant Research Foundation and the U. S. Department of Agriculture has set out to discover what's in the woods in Cuba. The purpose is to learn what is the most profitable way of utilizing the Cuban forests and to find out what kind of insect pests are most harmful and how to combat these. The party, which expects to complete its work in a year, consists of Dr. H. N. Whitford, Dr. J. R. Weir, mycologist and forest pathologist of the U. S. Department of Agriculture, and one trained assistant.

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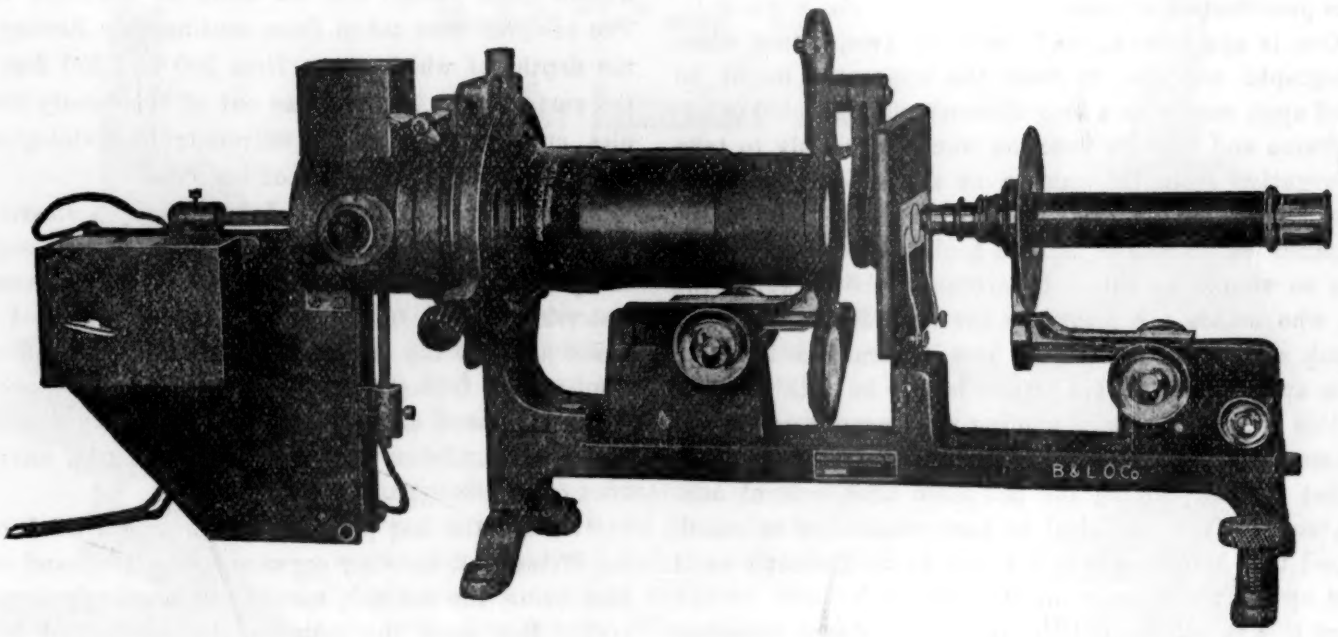

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SCIENCE NEWS

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PICTURES BY TELEPHONE

How the method of transmitting photographs by telephone lines has been developed into a regular commercial service, by which either a photographic negative or positive may be sent regardless of the character of the original, was described to the members of the Optical Society of America, meeting at Cornell University on October 30, by Dr. Herbert E. Ives, who has been largely instrumental in making the method a success. Dr. Ives is now retiring as president of the society, and he spoke on the subject in his presidential address.

"One is apt to imagine," said Dr. Ives, "that when photographs are sent by wire the apparatus might be looked upon merely as a long distance photographic printing frame and that its function would be simply to take the negative from the camera at the sending end and make a print at the receiving station some hundreds or thousands of miles away. The problem, however, is not quite so simple as this. In ordinary photography, the man who makes the print has the negative in his hand to look at, and he can decide how it should be handled. He is apt to make several trials before he gets it right, but this is not possible in sending photographs over wires because of the cost of the line time. This cost is similar to that for telephoning for the same time, several minutes, and so it is the ideal to have conditions so standardized that the telephone line can be used exactly as it is set up for transmission of the voice."

But this is not the only way that telephonic transmission of pictures differs from ordinary photography," said Dr. Ives, "for it opens up new possibilities. Thus it is possible," he said, "by adjusting parts of the apparatus, for a picture to be received as a positive or a negative, no matter which form the original may have. It is also possible to make the picture-transmitting apparatus produce the received picture with a structure of dots which may be directly used in making the zinc printing plates for use in the newspapers. Altogether, there are at least eight different ways in which a photograph might be handled in sending from one point to another."

As the chief justification for sending photographs by this method is the need for speed, the apparatus has been designed from the start to work with as few operations as possible. For instance, he said, the original picture may have been taken on a film or plate of any size, and so it is always necessary to make a photographic copy of it before it can be sent. Therefore, the machine is so constructed that the transparency films may be used while they are still wet, and it is not necessary to wait for them to dry.

At present, a regular service for anybody who wishes to use it is maintained between Chicago, New York and San Francisco. Where only one print is required it is usually received directly on paper as a print, but when it it done for a news agency, said Dr. Ives, it is preferable to receive a negative from which any number of prints may be made.

BACTERIAL LIFE BELOW EARTH SURFACE

First direct evidence of the existence of living things a thousand feet or more beneath the surface of the earth is claimed by Dr. Edson S. Bastin, head of the department of geology at the University of Chicago, and his associates, Frank E. Greer and Gail Moulton.

During the last summer the party, working in cooperation with the Illinois State Geological Survey, made chemical and bacteriological analyses of oils and associated waters from twenty-five oil wells of southern Illinois. The samples were taken from continuously flowing wells, the depths of which range from 500 to 1,500 feet below the surface. In twenty-three out of the twenty-five samples, cultures made in the university bacteriological laboratory show an abundance of bacteria.

"Ever since reading Sir John Murray's classic ocean researches," said Dr. Bastin, "I have always suspected the presence of bacteria in natural oil and its associated waters. Murray found that the waters enclosed in the black muds at the bottom of the ocean were different in composition from the typical ocean waters above them. The conspicuous differences were the paucity of sulphates and the abundance of hydrogen sulfide gas, having the odor of rotten eggs.

"Surely, the last place where one would think of finding living and thriving organisms is a thousand or more feet below the surface, encased in seemingly impervious rock. But since the cultures give undoubted proof of their presence I do not credit bacteria with being the least fastidious as to the situations in which they live.

"One is inclined to discredit the presence of bacteria more than a thousand or more feet below the surface because of the food problem," said the investigator. "But the lack of sulphates and the presence of hydrogen sulfide gas leads us to believe that the minute organisms are eating the sulphates and giving off hydrogen sulfide gas as a waste product of their simple bodily processes."

The bacteria found in the oil sands are, moreover, similar to those living in the ocean to-day. This is not surprising when we note that the oil-field waters are very similar to ocean waters in chemical composition. They are believed by many geologists to be ancient sea waters buried within the rocks millions of years ago and there preserved, with minor changes, to the present day.

Whether the bacteria in the oil-field waters are the lineal descendants of those living in the ancient seas and buried alive at the time the rocks were laid down in the sea-bottom, or have been introduced into the rocks later from the underground water circulation, is an interesting question that perhaps can never be answered. It is entirely within the realm of possibility, however, that bacteria may have existed in these oil-sand waters from very ancient times, for bacteria were among the earliest forms of life to appear on the earth, as is shown by the preservation of their impressions in some of the oldest rocks known to the geologist.

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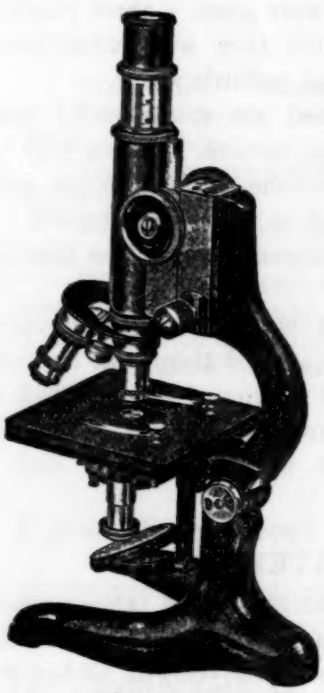

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CHANGES IN OCEAN DEPTHS

VESSELS of the U. S. Navy will soon be employed in an effort to locate a reported shoal extending southeast from Cape Hatteras, and reported recently by a merchant vessel, the *West Selene*, says Captain W. S. Crosley, chief hydrographer of the navy. This boat was forced towards shore in foggy weather and made soundings to avoid getting too close to the beach, but they found depths of only 300 feet where the navy department's charts showed three times as much.

Apparently, the report is correct, according to Captain Crosley, but alterations are not to be made on the charts until the changes have been officially verified. For this reason soundings by naval vessels in this region will soon be made. If the shoal is found, it will be most remarkable, he said, because it is certain that it was not there at the time the soundings on which the charts are based were made. The hydrographic office has no record of any such changes in the ocean bottom on any part of the Atlantic coast.

Changes have been found in other parts of the world, however, especially around Japan. They followed the great earthquake of 1923, and the Japanese navy is now engaged in an extensive survey to determine the extent of these changes. Similar changes in the Bay of Biscay, where, at a supposed depth of 24,000 feet, a depth of only 120 feet was reported, have not been verified. Soundings over this region have been made by a French naval vessel, the *Loriet*, and they found nothing abnormal.

Captain Crosley suggests that such reports might arise when a lead is used for soundings, as the line may become fouled before the weight reaches the bottom. The sonic depth finder is not subject to this source of error, and American naval vessels are now being regularly equipped with them. During the recent Pacific cruise of the fleet an extensive series of soundings were made, which the hydrographic office is now engaged in tabulating. This is expected to be especially valuable, as the only soundings now available of much of this area are those made when cables were laid to Alaska and to Guam.

TICK JUICE AS A PROTECTION AGAINST ROCKY MOUNTAIN SPOTTED FEVER

A VACCINE has been made from the ground bodies of disease-carrying cattle ticks that gives immunity to Rocky Mountain spotted fever, transmitted by the same parasites. Dr. R. R. Spencer and R. R. Parker, of the U. S. Public Health Service, have successfully vaccinated rabbits, guinea pigs, monkeys and human beings against this much dreaded fatal infection of the western cattle range. Up to the present time 34 persons have been vaccinated against the infection and none of these have succumbed to the disease.

We see no reason why injections may not be repeated each spring, said Dr. Spencer, in persons whose occupations definitely expose them to infection. It would be impracticable to vaccinate the general population of the spotted fever region, but it is believed the vaccine would afford a protection to those exposed. This would include residents, vacationists, laboratory and field workers, foresters, lumbermen, sheep herders, surveyors, hunters, prospectors and fishermen in the badly infected area.

The vaccine must be prepared from the infected ticks at the time when the virulence of the parasitic organisms that cause the disease is at its height. This is when the tick is in the adult stage. But the potent virus can not be obtained from the tick at the time of infection, for the organisms need an earlier start.

The experimenters brought up healthy adult ticks and placed fertilized females in pill-box wards, where they laid eggs. The eggs hatched to larvae and these were given a square meal off an infected rabbit. The larvae were nursed through the nymph stage and molted into adult ticks. These ticks were given a three months' rest and were well fed. Then they were eviscerated and ground up with sterile sand and salt water.

The liquid thus obtained was sterilized by means of carbolic acid, and used as vaccine. Guinea pigs treated with this serum were immune to the disease for eight months, which was as far as the tests extended. Vaccinated monkeys remained immune and others that had not been treated died.

A cattle dipper in the affected area had been vaccinated before he was bitten by infected ticks that he picked by hand off the cattle. He developed a mild form of the disease but was never in danger. He recovered completely while four other persons infected died within ten days.

ITEMS

INSULIN, Dr. F. G. Banting's world famous remedy for diabetes, the discovery of which won him a Nobel Prize, may be superseded within a few years in all but the most serious cases of the disease. Another Canadian research worker, Dr. J. M. Rabinowitch, has prepared a substitute for it, which has the great advantage that it can be taken by the mouth. Insulin is administered by injections. The substance which has been prepared by Dr. Rabinowitch is a sweet syrup, analogous to sugar, which is obtained from glycerin on which a certain bacterium has been allowed to act. It is known as dioxyacetone. Dr. Rabinowitch, assisted by Miss A. B. Frith and Miss E. V. Bazin, gave dioxyacetone by the mouth to sufferers from diabetes in the Montreal General Hospital. It was found to lower the blood sugar. It is expected to act as an efficient substitute for insulin in the future in most cases of diabetes where the disease has not advanced too far. Dr. Rabinowitch is at present preparing a detailed record of the cases in which dioxyacetone has been used.

RICH veins of radium, gold and other rare metals have been discovered in the Ekimchansky region of the Amur province, Siberia. A telephone line has already been constructed, cooperatives organized and general signs of life are present in this formerly desolate region. New deposits of phosphates were recently found in fourteen different localities of the government of Voronesh. The total area of these localities covers about 140 square miles and the deposits are estimated at 125,000 tons.

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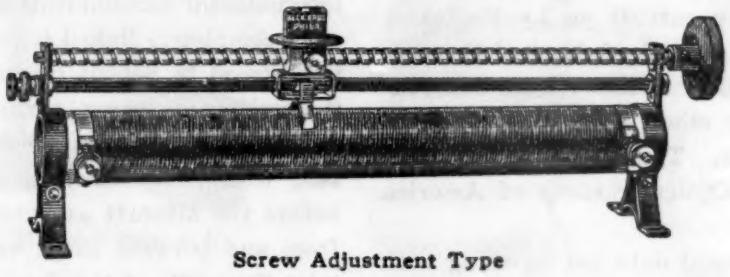

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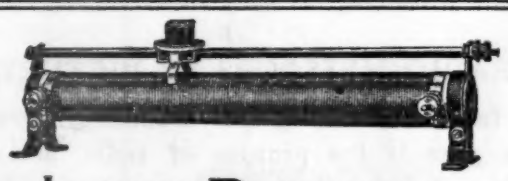

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SCIENCE NEWS

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THE ETHER DRIFT

MEASUREMENTS of the drift of the ether, supposed to pervade all space, which were carried on by Professor Dayton C. Miller, of the Case School of Applied Science, Cleveland, during the last summer at Mt. Wilson Observatory, seem to prove that the ether exists and that the Einstein theory is not correct. This announcement was made at the meeting of the Optical Society of America at Ithaca.

The possibility of experimental data not agreeing with the Einstein theory was tentatively reported by Professor Miller to the National Academy of Sciences last spring and an article by him on the subject has been printed in SCIENCE. The ether was found to drift more on the top of high Mt. Wilson while there was evidence that the ether clings to the earth closely in the cellar of Professor Miller's laboratory in Cleveland.

Since spring, Professor Miller has made a total of one hundred thousand measurements. At least two months will be required to compute the final results, but so far they seem consistent with the earlier work.

His research also shows that the sun is moving through space, carrying the earth and the other planets with it, to a point near the bright star Vega, in the constellation of the Lyre. This is in close accordance with astronomical measurements made at Mt. Wilson and the Lick Observatory of the University of California.

RADIO MESSAGES BY PICTURE

THE fac-simile radiogram commercially available within a year is the promise of radio, according to Major General James G. Harbord, president of the Radio Corporation of America, addressing a conference on education and industry at the University of Chicago. This is the fruit of long research work done in radio photograms. The received copy is a fac-simile of the original and its accuracy will be beyond question. The speed at which this work is being done is said to promise commercial value before the return of the next summer's static.

The problem of communication with Europe, General Harbard predicted, would also be solved in the near future. He mentioned the question of wavelength with regard to international communication. "The wave length," he said, "is a species of property. Losses in money and prestige would follow the deprivation of a particular wave length to which right had been established by actual use. These matters will have to be considered at an international conference, a form of calamity which has not yet afflicted the radio field, but is constantly threatening. An international conference can not be much longer delayed."

General Harbord painted a brilliant future for radio. He said in part: "It is not given to mortal man to read the future of an art with such undreamed possibilities. That it will grow to be one of the towering industries of our country may be safely ventured as a prophecy. In international communication I can visualize a world even more completely linked together. Every part of the world is destined to benefit by improved communications. Entire written messages, perhaps newspapers, will be flashed as complete pictures or documents. Efficient communication with commercial aircraft will be ready probably before the aircraft are provided. Marine service to and from and between ships will even more completely minimize the perils of the deep. Television is not far distant. Static will be chained a captive at the wheels of radio progress. International broadcasting will become a commonplace. The operas of Europe will compete with our own. The incomparable music of the countries to the south of ours will be heard in American homes. Entertainment and instruction will penetrate to the remotest corners of the earth. In time of national crises or great emergency, presidents will appeal to our millions in tones of voice that will be recognized. The temple bells of Asia will chime for us, and from the land of old religions will come the philosophies of ancient races. The oldest and newest civilizations will throb together at the same intellectual appeal and to the same artistic emotions."

THE AUTOGIRO

"THE most important step in aeronautical progress since the Wright brothers flew the first airplane." This is the way in which Vice-Marshall Sir Sefton Brancker, of the British Air Force, described the interesting combination of airplane and helicopter, the autogiro, invented by Juan de la Cierva, Spanish civil engineer, which has had trials at Farnborough recently.

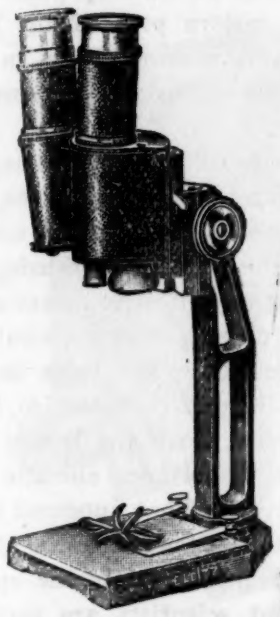
It has been announced that as a result of these tests several machines with modifications will be built for the air ministry.

The autogiro is an airplane that has had its wings clipped, as it were, and it has a second propeller on a vertical axis above the fuselage which exerts a force downward, tending to keep the craft from falling. This vertically mounted propeller is similar in shape to the conventional propeller with which an airplane is equipped, but it has a diameter equal nearly to the wing spread of the craft itself.

When the air-screw on vertical axis is started with sufficient power to give 120 revolutions per minute, the autogiro leaves the ground with the very low ground speed of fifteen miles an hour, according to measurements made during the Farnborough tests.

The autogiro invented by Senor de la Cierva and recently tested in England was first tested in October, 1920, just five years ago.

Although leading aeronautical experts connected with the government at Washington do not share the reported optimism of the British authorities as to the importance



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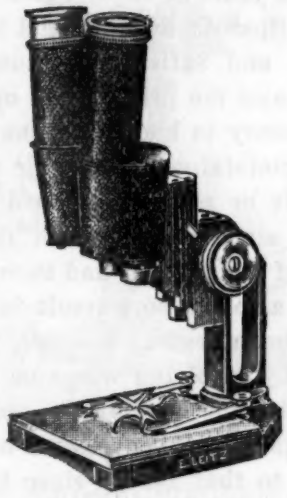

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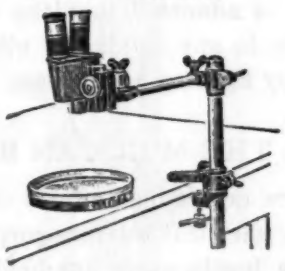

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of the autogiro, yet its developemnt has been looked upon with interest.

Three years of experiments were necessary on the part of the Spanish inventor and his associates before a successful and satisfactory autogiro was developed. To understand the principle of operation of the autogiro, it is necessary to know that the ordinary airplane in order to be maintained in the air must have a high velocity. The lift or pressure upward that sustains the airplane in the air decreases much faster than the decrease in speed of the airplane and therefore a small loss in velocity of the airplane may result in a catastrophe.

In the autogiro, however, the sustaining lift is produced by revolving wings on a vertical shaft projecting from the fuselage of an ordinary airplane. However, although it may look like a helicopter, it does not really belong to that family since the sustaining propellers of the helicopter are operated directly by the engine, whereas in the autogiro the wind produced by the motion of the aircraft actuates the blades. If the craft had not been christened autogiro, it might be called an "airplane with revolving wings."

It is claimed that the autogiro is not affected materially by loss of speed. If there is an engine failure, a sudden "nose up" or a very sharp turn, the horizontal flight of the craft may be interrupted and it may be forced toward the ground, but the sustaining blades will keep it in the air and enable it to alight at a very low speed. The stalling of the engine while in flight over rough ground, which would be fatal to an ordinary airplane, would be a mishap of minor importance to an autogiro. On the other hand, it is admitted that the autogiro will probably be unable to do any looping or other stunts such as are performed by fighting airplanes.

THE MEXICAN BEAN BEETLE

DESPITE determined efforts of the U. S. Bureau of Entomology chemical warfare corps to dislodge it, the Mexican bean beetle army has held its own during the past summer and has even begun the conquest of another northern state. Although it has been in the South for five years, and has thoroughly established itself in the heart of Dixie, the beetle made no serious invasion of the North until 1924, when it annexed the state of Ohio, reaching the shores of Lake Erie at a number of points. This year it has widened its salient and established a line across the southeastern part of Indiana.

Elsewhere the depredations of the beetle have not extended greatly beyond last year's holdings; some eastward extension in the mountainous regions from Pennsylvania southward to North Carolina has taken place, but little new territory has been seized elsewhere. These small eastward drives, however, are causing officials of the Bureau of Entomology some concern; for if the insect army passes the natural barrier of the Appalachian chain it may overrun the Piedmont and Coastal Plain regions.

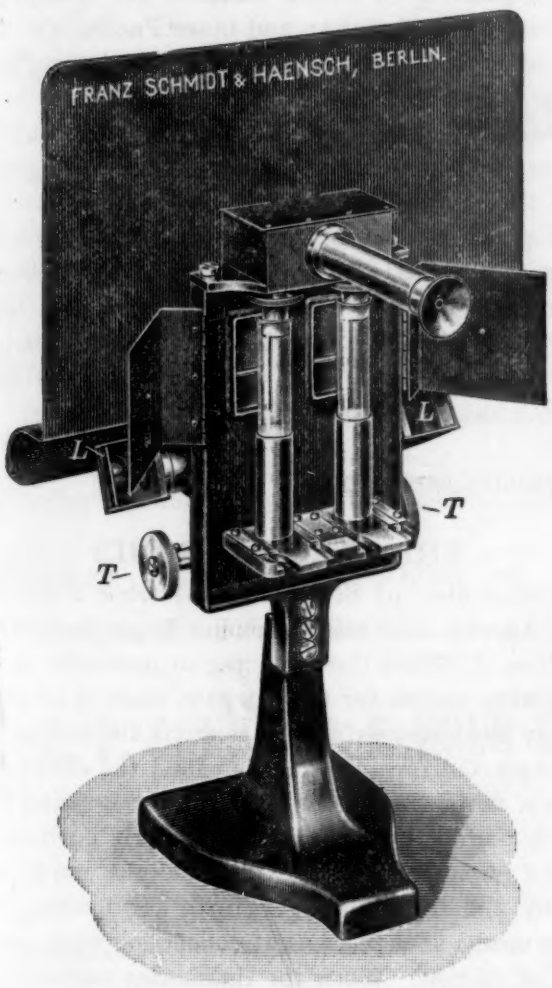
The Mexican bean beetle, according to J. E. Graf, who is in charge of the bureau's work on truck crop pest investigations, is a sneak as well as an enemy. for he appears in the uniform of a large lady-beetle, which we have always been taught to regard as a friend. But there are several lady-beetles in Mexico that prey on man's crops instead of on the enemies of his crops; this is the first that has invaded the eastern part of the United States, appearing, no one knows whence or how, in northern Alabama in 1920 and extending rapidly north and eastward each year.

Though the adult beetle does considerable damage, the real harm is done by the squashy grubs or larvae, which feed voraciously on the leaves of all kinds of crop and truck plants, skeletonizing the leaves and causing them to turn yellow. Thus far the only effective means of combat have been spraying and dusting with arsenical chemicals. The Bureau of Entomology has twice imported natural parasitic enemies of the pest from Mexico, but the parasites have failed to survive, while the beetle, apparently more easily adaptable to northern climatic conditions, has remained and thrived. What appeared to be a bacterial disease broke out among the beetles in Alabama a couple of years ago, but unfortunately the epidemic died out again. Government scientists are continuing their researches on diseases and natural enemies of the beetle, hoping that eventually a means of control less expensive and laborious than poison spraying and dusting may be found.

ITEMS

EITHER tortoises are deaf, or else much less intelligent than generally supposed, according to a report of experiments by Ryo Kuroda, of the College of Niigata, Japan, in the next issue of the *Journal of Comparative Psychology*. In previous experiments with snakes, Kuroda found that most water snakes have no hearing ability while land snakes often have an acute hearing. To further this work, it was decided to experiment with the tortoise which is a more advanced member of the reptile family. An experimental group of several tortoises was used. Scraps of meat, which is a favorite food, were laid upon a broad copper plate which was connected with an electrical circuit. When the experimental animal attempted to snap the meat from the plate, a bell was rung and at the same time an electric current passed through the plate giving the animal a shock. If the animal were able to hear it would soon learn to associate the sound of the bell with the coming shock if the attempt to snap up the meat were made. Repeated trials with individual animals revealed no reaction to the bell sound associated with the electrical shock. As a result the experimenter was led to the conclusion that the tortoise does not have a developed sense of hearing.

CULTIVATED cotton may be crossed with a tree just rescued from complete extinction in Hawaii to make bigger cotton plants and take the kinks from the backs of cotton pickers. Such is the possibility foreseen as a result of the announcement received here of the success obtained at the Department of Agriculture's Plant Introduction Garden at Miami, Fla., in growing *Kokia Drynarioides* from seed. There is only one other tree of this species in existence and that is the one from which the seeds were obtained. It is a close relative



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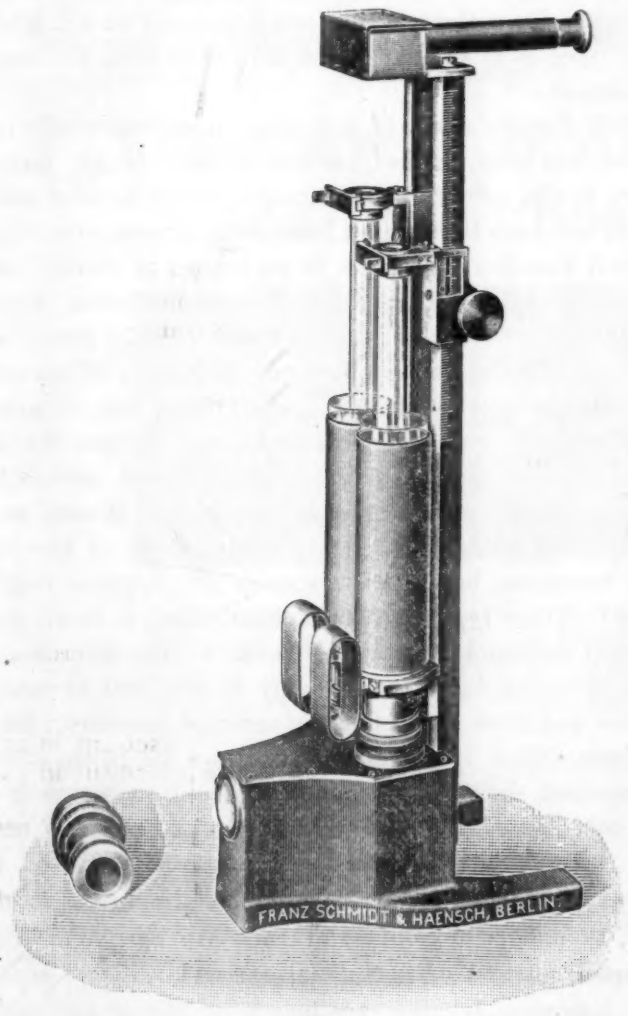

Colorimeter No. 3

the cotton plant, and it has been suggested may be of value for crossing with the cultivated cotton. It will take a few years, however, to get specimens in cultivation here. The experts now pin their hopes on getting more seed from the only parent tree at Kauluwai. Even if crossing does not succeeed this cotton tree will prove an attractive ornamental plant as it has long-stemmed, heart-shaped leaves, and bright-red silky flowers.

A STEAM boiler of revolutionary design has been produced by a German engineer-inventor, Bernard Becker, of Nohra, near Weimar. When stripped of its insulation, it is a cubical box only about eighteen inches on a side; but according to its inventor's claims it can produce over 600 pounds of steam per hour and can get up a pressure of 300 pounds per square inch in five minutes. Its action depends on the introduction of water not as a liquid, but as a spray of almost mist-like fineness. This is injected into an intensely heated coil of jointless tubing, where it is almost instantly converted into high-pressure steam. There is a small steam chamber, but no water reservoir. The new quick-steaming boiler is thought likely to be useful in automobiles and farm motors.

REVERSED SNAILS

IN the Science News Supplement of SCIENCE for October 9, 1925, appears the following:

"A given species will twist to the right or to the left, never both; for a 'left-shelled' snail to occur in a 'right-shelled' species is as unheard of as a man with his head on backwards."

Probably every one who has made a serious study of mollusks has seen, if he has not himself found, many reversed snails, as well as occasional reversed bivalve mollusks. They have been found in so many genera of widely separated families that there is no reason to doubt that they may sporadically occur in any genus or species. Usually only one or two reversed specimens may be found at a given locality, out of hundreds or thousands of normal examples, but species differ in this respect and in some genera numerous reversed specimens are sometimes found. In the genus *Oreohelix* almost any large colony, especially of the two most common species (*O. cooperi* Binney and *O. depressa* Cockerell), is likely to yield one or two reversed examples, but another species (*O. haydeni mixta* Pilsbry) at the type locality yielded about a dozen out of several thousand normal specimens. On the other hand, I have collected *Lymnaea* of many species and at many localities and have found but one reversed specimen; they have been found in abundance in some localities. The only reversed shell of the genus *Bittium* I have seen is a fossil one. *Pupilla syngenes* Pilsbry and Ferriss is normally dextral, but its variety *dextroversa* Cockerell is sinistral (left-handed), and two forms are often found mixed, though pure colonies of each are reported. The wonderful colonies of mixed dextral and sinistral snails of the Hawaiian Islands have long been known and much studied. Many naturalists have hoped that the intensive study of such colonies would ultimately throw important light upon the problems of evolution. In most genera the reversed examples are so scarce and sporadic that it is almost impossible to obtain material for breeding purposes, but in the Hawaiian and other Pacific islands they are so abundant that no such difficulty is encountered. However, even in other regions enough material has been found with which to experiment in the breeding of reversed examples representing quite a number of genera of snails,[1] the results of which have a very important bearing upon the problems of inheritance, whatever their effect may ultimately be upon the problems of evolution.

Since the foregoing was put into type, Dr. Henry A. Pilsbry has called my attention to the very interesting fact that some snails, such as *Lanistes*, have sinistral shell with dextral animal.

JUNIUS HENDERSON

UNIVERSITY OF COLORADO

THE ELECTRIC SQUIB

IN the number of SCIENCE for October 9 appears an article "Scrap Iron and Dynamite Suggested for Frost Protection." While the exploding of dynamite in the air is, of course, useless for this purpose, there is an explosive accessory used successfully in some of the orange groves in southern California, which is called the electric squib. This is a device primarily intended for igniting charges of black powder by means of an electric current. It is also used for igniting charges of flashlight powder in photography and in the orange groves for igniting the oil pots by means of a thermostat connection with a suitable source of current. When the thermostat registers a temperature near the danger point for frost, the electric squibs are automatically fired, which in turn ignite the oil pots and start the heat in the orchards.

It is just possible that some observer, seeing these explosive accessories connected to the smoke pots, jumped to the conclusion that dynamite was in some way involved.

ARTHUR LAMOTTE,
Manager of the Technical Section of
E. I. du Pont de Nemours and Company

THE SPEED OF LIGHT

THE editor of *Science Service* wishes to have two corrections made in the note on the "Speed of light" appearing in Science News last week. It should be stated that the velocity of light has been measured to an accuracy of one part in 10,000. There should be substituted for the first paragraph on page xii the following: "If the velocity of light can be found accurately it will establish a new unit for time measurement. This unit is changing with time."

[1] See, for example: *Journ. of Genetics*, XV, 114–200, 1925; *Proc. Roy. Soc.*, 1925 (95-B), p. 207; *The Nautilus*, XI, 70, 1897; *ibid.*, XXXIX, 21–24, 1925; SCIENCE, n. s., LVIII, 269–270, 1923, and other publications discussing the breeding of reversed snails, together with very numerous reports of the occurrence of reversed snails under natural conditions.

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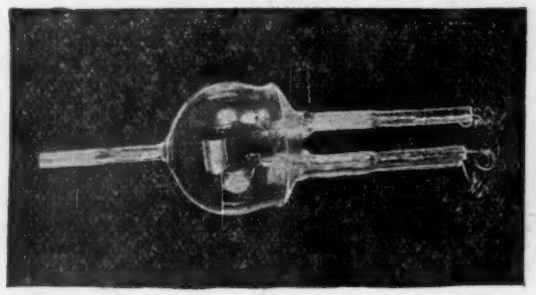

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SCIENCE NEWS

Science Service, Washington, D. C.

THE MADISON MEETING OF THE NATIONAL ACADEMY OF SCIENCES

Special telegrams sent from Madison by Watson Davis, managing editor of Science Service

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THE earth is being bombarded from all directions and at all times by rays more powerful, more penetrating and of shorter wave length than even the X-rays and gamma rays from radium, until now the most penetrating radiations known to science.

This amazing discovery of what might be called super X-rays was announced to the National Academy of Sciences meeting at the University of Wisconsin by Dr. Robert Andrews Millikan, director of the Norman Bridge Laboratory of Physics of the California Institute of Technology, Pasadena, California, and winner of the Nobel prize for physics on account of his pioneer work in measuring the electron.

From out of space, born evidently in the great cosmic reaches of the universe, these newly discovered rays come to earth with a penetration at least a hundred times greater than the most penetrating X-rays which can be produced in our hospitals. Whereas X-rays can not go through half an inch of metallic lead, it takes six feet of lead to completely absorb these cosmic rays which Dr. Millikan said are "harder and more penetrating than any which had before even been imagined."

Hearing Dr. Millikan was like being present when the Curies announced the discovery of radium, Roentgen reported the first generation of X-rays or Hertz sent the first wireless waves. For he has discovered a new realm of the spectrum. The idea of a series of ether vibrations ranging from low frequencies of alternating electric current, passing through radio waves, heat, visible light, ultra-violet light and finally reaching the short wave lengths of X-rays and gamma rays of radium is familiar to us. But far beyond these, approaching the abode of the infinitesimal, lies the region of the penetrating rays discovered by Dr. Millikan.

"Our experiments indicate that there is a region of frequencies as far above the X-ray frequencies as are these latter above the frequencies of light waves," said Dr. Millikan.

The wave length of the shortest of the "penetrating rays," as he calls them, is but one fiftieth of that of the hardest gamma rays from radium heretofore known and but one ten millionth that of ordinary light. And light has a wave length of about one fifty thousandths of an inch, which, so far as every-day measurements go, seems nearly the limit of minuteness.

Whence come these powerful rays?

Over five years of experiments, which took Dr. Millikan and his assistants to the top of Pike's Peak, caused them to probe the upper atmosphere with marvelous featherweight instruments lifted by small balloons, and carry on experiments sixty feet deep in a snow-fed lake under the brow of Mt. Whitney, proved conclusively that these penetrating rays do not originate on earth.

They are the result of transmutation of chemical elements taking place in the vast expanses of space. The gamma rays are produced only by nuclear transformations within the atoms of radium and thorium, in other words, when these elements disintegrate or are transmuted into other elements. Reasoning from such well-known facts, Dr. Millikan concluded that nuclear changes, that is, transmutations of elements, having an energy perhaps fifty times as great as the energy changes involved in known radioactivity on earth are taking place all through space. And the most probable sort of nuclear change is the capture of an electron by the positive nucleus of an atom. Thus the penetrating rays are signals of these cosmic transmutations sent to earth.

If the dream of the ages was accomplished here on earth and gold was made from mercury, the penetrating rays, Dr. Millikan has discovered, should be given off as a result of such a transmutation.

But to produce here on earth the penetrating rays, Dr. Millikan estimates that the immense energy of ten million volts or more would be necessary, and he holds out little hope of such an accomplishment. Consequently for the present at least the application of the penetrating rays to medicine and physics can not be anticipated.

Fortunately the amount of the penetrating rays reaching the earth is very small. Very delicate gold-leaf electroscopes were necessary in order to detect the rays in spite of their high penetration. The rareness of the rays is probably the salvation of life on earth, for if the quantity were large the effect might be like being treated with very heavy doses of X-rays.

Unlike light or any other radiation from outer space, the penetrating rays come to earth with equal intensity at all hours of day and night and with the same intensity in all directions. And when they strike the rocks on earth they stimulate softer rays whose discovery Dr. Millikan made as a by-product of the principal investigation.

The ultimate fate of the solar system of which the earth is a part is that it will become two stars, one of them the sun and the other a new star made up of all the planets with Jupiter as a gathering point.

This is the prediction of Professor W. D. MacMillan, of the University of Chicago, upon the basis of new mathematical studies.

Yet there is no need for immediate preparations for the judgment-day, for Professor MacMillan estimates that it will probably be some five hundred billion years before Jupiter becomes a star and swallows the earth in the process of doing so.

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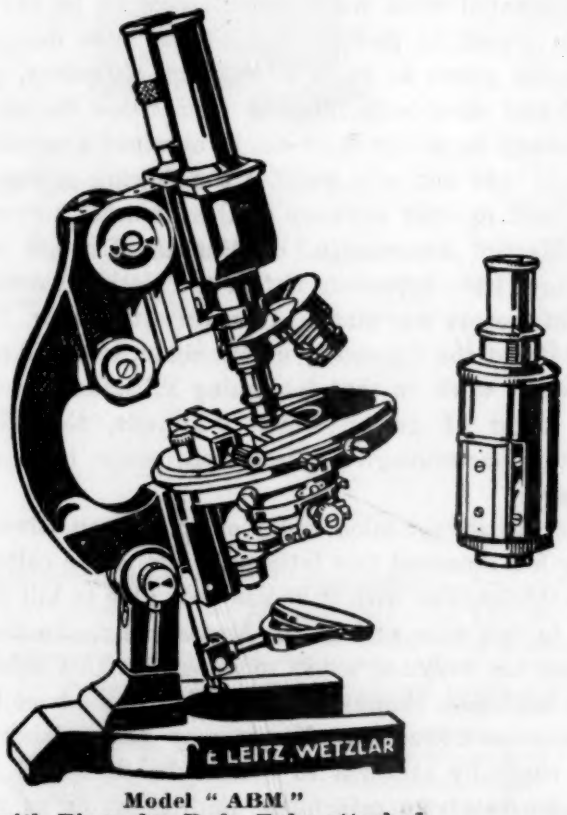

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are sweeping up the cosmic dust or nebulosity throughout space somewhat as a snowball increases in size, and when the planets have gathered up enough matter they will be gobbled up by the largest of them due to the action of the laws of gravitation. The result is a star. A considerable percentage of the stars in the heavens are binary and Professor MacMillan considers it probable that many of them at one time were solar systems.

Looking so far into the future and into the past has greatly changed astronomers' ideas of the lifetime of a solar system. Whereas they used to think a solar system had a life expectancy of a mere hundred million years, Professor MacMillan now estimates it at a million billion years, called for convenience an eon. Once an eon, on the average, a star will make a close approach to the sun, an event which would be explosively disastrous to our part of the universe whether it happened while the earth still existed or when the earth had long since disappeared in the clutches of Jupiter.

Dr. R. A. Millikan's startling announcement of the discovery of ultra X-rays of great penetration and cosmic origin continued to be the chief topic of conversation among the leading scientists.

It was realized that these extraordinary rays detected by Dr. Millikan are evidences of the actual construction of matter throughout all space. He suggests that they may be evidence for the condensation into matter out somewhere in space of the light and heat continually being radiated into space by the sun and stars. Our own sun dissipates into space each second some ten million tons of mass in the form of light.

It is a hopeful conception that in some other part of the universe this fundamental stuff and that emitted by all the other stars is being synthesized into matter from which other worlds can be made. How much more cheerful this is than the disintegration that accompanies radioactivity.

The Millikan rays also probably affect vitally radio communication for near the top of the atmosphere where they first impinge on the earth they help to create the ionized conducting Kennelley-Heviside layer of the atmosphere along which radio signals slide. In fact, the Millikan rays and the forces behind them may easily be one of the few universal fundamental laws or facts and may be in the same class with gravitation.

Such constructive evolution as revealed by Dr. Millikan's discovery and hypothesis is not confined to the physical side of the universe alone. Dr. J. C. Merriam, president of the Carnegie Institution of Washington, after a study of the past of the earth and man declared to the academy that "the future is not one of melancholy decline."

His investigations led him to believe that the Neanderthal men of Europe, considered by some to be abortive offshoots from the main stem of man's evolution, are actually man's ancestors. Viewing the long road that man has trod to his present estate, Dr. Merriam predicted that the human race would some day reach a level at least twice that now attained.

Such gigantic conceptions of the universe and the future are the product of the cerebral cortex, a relatively recent invention in the history of life. Professor C. Judson Herrick, of the University of Chicago, told the academy that it is the special business of the cortex portion of the brain to fit previous experiences into the present situation so that we can react to our past as well as our present.

River water that sterilizes itself against typhoid and other similar diseases, corn and wheat that have been bred to resist disease and a drug that restores to sanity sufferers from paresis were among the new achievements of science.

Contaminated river water would seem to be the last place to expect to find an antidote to such dangerous water-borne germs as those of typhoid, dysentery, paratyphoid and other such ills, but from below the sewage outlet of any large city there can be obtained a mysterious substance that not only purifies the flowing stream but can be used to treat sufferers of the diseases.

Dr. Martin Arrowsmith, of Sinclair Lewis's novel, might have been appearing before the National Academy when this report was made. In reality it was Dr. Philip B. Hadley, of the University of Michigan, who told of the most recent work on that intriguing substance, bacteriophage, eater of germs, which d'Herelle, the French-Canadian bacteriologist, discovered some half dozen years ago.

From the sewage-filled water of the Huron River, Dr. Hadley has obtained this lytic principle, as he called the bacteriophage, and with it he has been able to kill deadly germs in test tube and in the human body. In time of epidemic the evidence seems to show that this substance can be used as a prophylactic. In fact the advice to the public in such times of danger may be to drink river water carefully strained to remove bacteria and retain the defensive lytic principle. Boiling water as recommended now may become obsolete.

It was with the bacteriophage that Arrowsmith of the novel combatted plague. To-day in Europe and in South America the bacteriophages active against typhoid and dysentery are being used in the treatment and prevention of these diseases. America has been slow to make use of this puzzling antagonist of bacteria in its fight against disease and Dr. Hadley urged more hospitals to experiment with it.

A controversy has arisen as to whether the bacteriophage is a living substance or just a chemical effect. It seems to grow and reproduce itself like a germ, but the most powerful microscopes have failed to reveal it and in other respects it does not seem to be a living organism.

To those who suffer from paresis, a form of insanity due to syphilis of long standing, there is hope in the report made by Professor A. S. Loevenhart, of the University of Wisconsin, that tryparsamide can restore to right mind a third to half of these who have reached the stage of insanity. This arsenical drug was first made by workers at the Rockefeller Institute for Medical Research, and it has previously proved effective in the treatment of the sleeping sickness, that plagues Africa.

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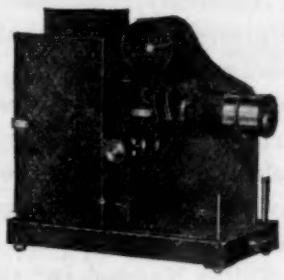

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versity of Wisconsin under the direction of Professor L. R. Jones. Dr. J. G. Dickson of his staff told the National Academy that a new breed of corn resistant to seedling blight is to be released to the farmers this fall and that wheat similarly immune is being developed, while Dr. G. W. Keitt announced that apple scab is about to be conquered.

Working in greenhouses in which all sorts of weather and conditions can be produced at will, Dr. Dickson found that the fungus causing seedling rot was thwarted in its attacks upon the tender plant when the plant builds up a woody armor. This happens in the case of corn when the soil is warm, whereas in cold weather only mucilage-like substances are grown which provide a luxurious and destructive living for the fungus. The new corn has been bred so that it will grow as resistant to the fungus in cold weather as in warm.

THE GERM OF SLEEPING SICKNESS

THE organism that causes sleeping sickness, or *encephalitis lethargica,* which has mystified scientists since the first appearance of the disease in Vienna during the world war, has at last been identified by Miss Alice C. Evans, of the U. S. Hygienic Laboratory. The organism belongs to the streptococcus group of bacteria. It varies so greatly in size that it can pass through the finest filter devised by science, and yet it grows so large at other times that it can easily be seen with the ordinary microscope.

The disease is not the same as the African "sleeping sickness" that is caused by an organism carried by the tsetse fly. *Encephalitis lethargica* has been thought by some scientists to be due to the same organism that causes influenza, because it has followed influenza epidemics.

Miss Evans obtained the sample streptococci, with which she experimented, from the brain of a patient who had died of sleeping sickness at St. Elizabeth's Hospital for the Insane at Washington. The organisms were cultivated in test tubes and used to inoculate rabbits. The animals contracted the same disease, and after death the identical organisms were found in great quantities in the rabbits' brains. The disease was given to other rabbits by means of germs recovered from the brains of the ones that had died; this was continued until a succession of seventeen rabbits had been killed by the descendants of the original streptococci taken from the brain of the human case.

The organisms are not very hardy, and when kept for a long time under artificial conditions they lose virulence. Miss Evans also noted that when very small doses of strong streptococci were injected into rabbits they did not contract the disease immediately, and when they did so, it took a long time for them to die. In other words, small doses gave them a partial immunity.

Sleeping sickness has been more prevalent in the United States than is commonly believed. Altogether, since the appearance of the first case in 1918, not far from a thousand cases have been registered in cities with a total population of about 22,500,000. The disease causes irreparable injury to the brain, and patients who recover are generally mentally abnormal. The three cases that occurred in St. Elizabeth's Hospital for the Insane were of persons who had had an acute attack of the disease from four to six years before.

ELEMENT 75

(By Cable to Science Service)

ACCORDING to a cablegram to *Science Service* from London the missing chemical element number 75 has been discovered by Dr. J. Heyrovsky, professor of physical chemistry at Charles University, Prague, and Dr. Doleysek, of the Prague Academy of Sciences. The element has been named bohemium, in honor of Bohemia, and was discovered as an impurity in magnesium through the use of the mercury drop electroscope. Professor Heyrovsky was a pupil of Ramsay who discovered several elements, including argon. The discovery of element 75 is also claimed by Professor Walter Naddack, of the University of Berlin, working with Otto Berg and Ida Tacke. On June 17 a *Science Service* dispatch from Berlin told how they had identified both numbers 43 and 75, known to be closely related, through the use of X-ray analysis and spectra. They selected the names, rhenium and masurium, as the elements 75 and 43, respectively, in honor of regions lost to Germany as a result of the war.

From the arrangement of the chemical elements based on laws developed by Moseley, the English physicist killed at Gallipoli, the properties of missing elements can be predicted. From such theoretical evidence it is known that elements 43 and 75 should be closely related and that they should also have physical and chemical properties allied to manganese. If one or the other of the two claimants for the honor of occupying niche 75 is successful, and if element 43 has been discovered as claimed, only three missing chemical elements will remain to be discovered. These are numbers 61, 85 and 87.

ITEMS

ONE thousand volunteers, who can be called upon to give their blood in transfusion cases, are being enrolled by the London Blood Transfusion Service, a little known branch of Red Cross work. This service to London hospitals was organized five years ago because doctors found it so difficult to obtain blood of the right type when a transfusion was necessary to save a patient's life. The blood of each human being belongs to one of four chemical types, and an individual who is willing to transfer some of his blood can be used only if he has blood like that of the patient. The classification is based on the presence or absence of two substances which are found to be hereditary. One type of individual has blood containing substance A; a second type has substance B; a third has neither A nor B; and a fourth, which is comparatively rare, has both A and B.

To date the London transfusion corps has served 247 cases, but calls from hospitals have become so numerous that a few hundred volunteer reserves are no longer enough. The organization states that calls come in at all hours of the day and night. It has its members classified according to blood type, and within an hour of the request the service has a volunteer of the proper type at the hospital.

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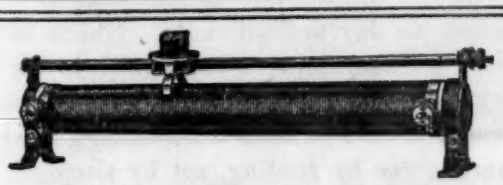

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SCIENCE NEWS

Science Service, Washington, D. C.

THE SIGHT OF BIRDS

DENYING the plausibility of the long-accepted notion that bright feathers of male birds serve to attract their mates, Dr. Austin H. Clark, of the U. S. National Museum, has announced that the structure of birds' eyes and direct observation of their relation to their environment indicate that both the bright colors of the male and the modest hues of the female hide the wearers from their sharp-eyed enemies.

The idea that our most conspicuous birds are hidden by their brilliant coats appears paradoxical, but Dr. Clark points out that the conspicuousness depends on who does the looking. The secret lies in the construction of the bird's eye. It differs chiefly from our own and other mammals' eyes, he says, in being built about a lens of shorter focus. The image projected by the lens of a bird's eye therefore lies all in one plane or nearly so, resulting in the equal definition of all the objects in the field of vision. This is necessary for an insectivorous bird catching its prey upon the wing or for a predaceous bird. Distance means little to them, detection of their victims everything.

To a predaceous or an insectivorous bird, therefore, a landscape consists of a clear-cut patchwork of myriads of fragments of all sorts of colors and of sizes. Each stick and stone and leaf stands out sharply, no matter how distant. Against such a background, Dr. Clark explains, those objects must be least conspicuous which are most boldly colored in sharpest contrasts, dark and light, regardless of what the colors are.

In the relatively long-focus mammalian eye, sharp vision is possible in only one plane, which is continually shifting back and forth. Beyond this plane the landscape becomes blurred, and tends to be reduced to the average color of all its various elements, so that the creature least conspicuous to a mammal is the one most nearly like the average color.

The dull coated female bird which stays near the nest is therefore protected by her color from attack by mammals, Dr. Clark maintains, while the brightly colored male living in the tree tops and perching on the ends of branches is protected by the gaudier hues from attack from other birds with their wonderfully perfect eyes.

PHYSICAL CONDITION AND EXERCISE

THE commonly accepted idea that good physical condition is a safeguard against infection from disease germs has received somewhat of a blow from the results of experiments carried out by the late Dr. Reynold A. Spaeth in the laboratory of the Johns Hopkins School of Hygiene and Public Health. Dr. Spaeth found that female white rats which were "in training" as a result of exercise resisted one type of pneumonia infection less well than control rats kept in restricted quarters, where exercise was impossible. It is as yet too early, Dr. Spaeth felt, to advance any theory in explanation of this unexpected situation. The experiments, however, dispose of a suggestion that had been brought forward to account for the results of some earlier work on the same public health problem—the relation between physical condition and resistance to infection.

In a series of earlier experiments from the same laboratory it was found that, in both guinea pigs and white rats, animals that had been fatigued to the point of exhaustion by forced running in motor-driven drums resisted infection more successfully than rested, unfatigued animals. It was suggested that the exercise, even though carried to what from the animal's point of view was certainly excessive lengths, was responsible for the higher resistance. The experiments on white rats, where the animals ran spontaneously many miles and were in the pink of condition and yet failed to resist the infection as well as the controls, made that theory untenable.

It is of interest to note that among white rats the female is the more strenuous sex. The males were so slothful that they were finally eliminated entirely from the experimental cages. They persisted in behaving merely like an extra set of controls. The most active female ran nearly one thousand miles while the least active male ran, during the same time, less than one thousand feet. Female white rats run farther and are more active in the presence of the males, but even after the latter had been eliminated from the experimental cages, the females' performance still entitled them to be called "athletes" in contrast to the inactive controls—and the lazy males. And these athletes were less able to cope with infection than the sedentary males.

Experimenting next with guinea pigs Dr. Spaeth sought for an answer to the query: Why are athletes so fragile? Going over the results of these experiments, he was forced to the curious conclusion that these animals owed their resistance to infection, neither to exercise nor to fatigue but to the fact that they were in a temporarily starved condition. The exhausted guinea pigs, which withstood infection better than the well-fed controls, lost as much weight during the hours in the motor-driven drums as though they had been partially starved for several days. Guinea pigs, like all herbivorous animals, eat or at least nibble almost all day and all night. Unless herbivorous animals can get concentrated food-stuffs in the form of grain, they have to keep feeding most of the time in order to get enough to eat. Unlike white rats, guinea pigs recover from fatigue by feeding, not by sleeping. Just as soon as they are able to drag themselves to the food troughs, they feed ravenously, rapidly regaining their normal weight. An analysis of the results of the earlier experiments showed that whenever an experimentally infected guinea pig gained weight on the day after infection, that animal lived. The converse was not invariably true—that is, many animals lost weight and still recovered; but among those who succumbed to the infection there was not one that had gained weight the day after infection.

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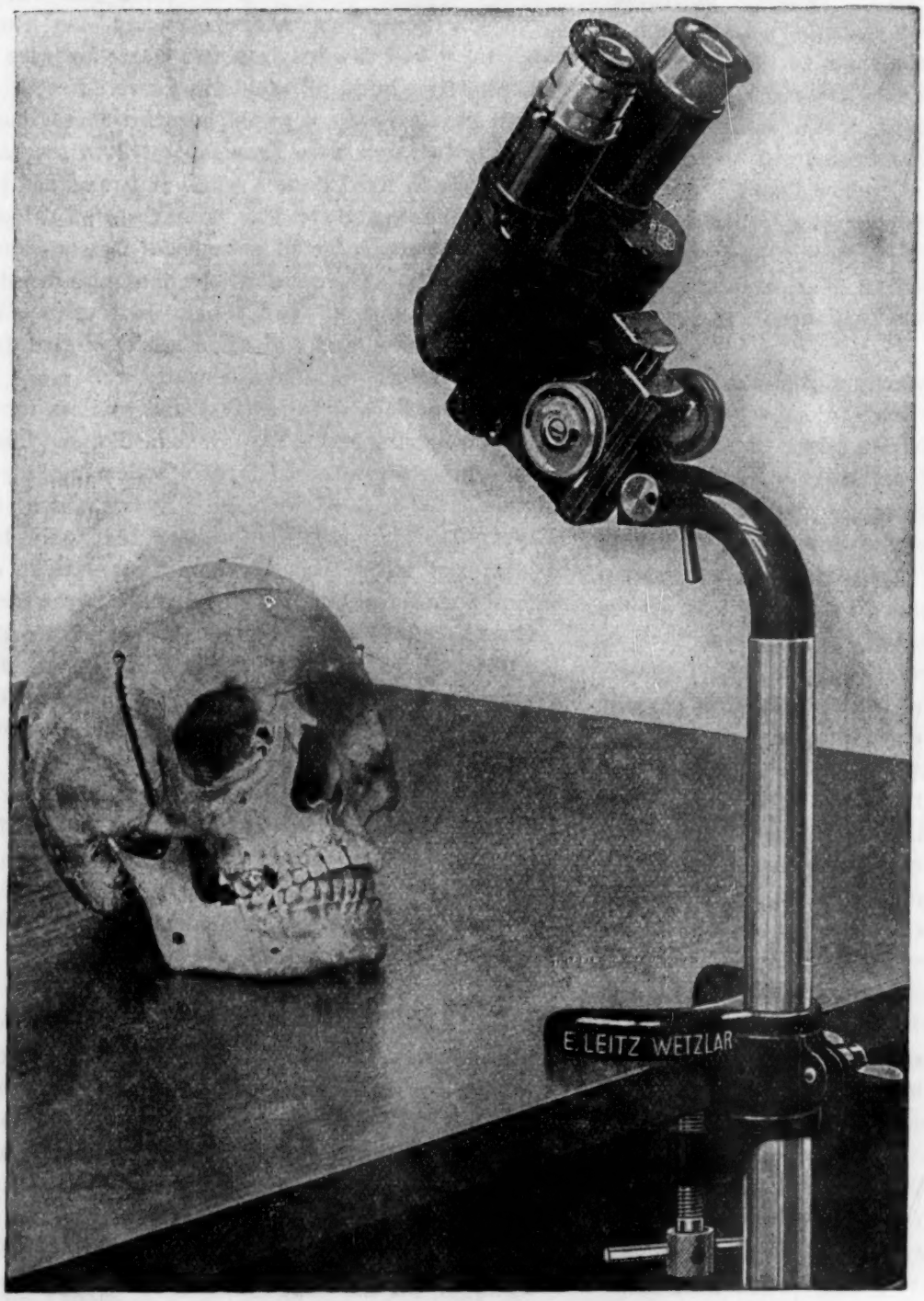

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ANNIVERSARY OF THE CONQUEST OF YELLOW FEVER

TWENTY-FIVE years ago two "buck privates" and a few medical officers of the U. S. Army under Major Walter Reed at a camp in Cuba offered their lives and were experimented upon in order that yellow fever might be conquered.

"Among the truly great scientists who have blessed the race by putting into man's hand the means of protection from the most deadly diseases belongs Walter Reed," said Dr. Victor C. Vaughan, chairman of the Division of Medical Sciences of the National Research Council, in commenting on the anniversary. "His name is placed along with those of Jenner and Pasteur by the work he did in determining the cause of yellow fever."

Dr. Vaughan is now the sole surviving member of the "typhoid commission" on which Major Reed served at the close of the Spanish-American War, and which was established to fight the epidemics that raged among American troops.

"Yellow fever is now practically wiped out, except for small areas back of Bahia, in Brazil," said Dr. Vaughan, "and perhaps for spots in Africa where a mild disease somewhat similar to yellow fever still occurs, and which some authorities believe is where the disease first originated. A commission from the International Health Board of the Rockefeller Foundation went to western Africa in July for the purpose of studying this disease and determining whether it is truly yellow fever.

"Another school of medical thought claims that yellow fever existed in America before Columbus arrived, and that Columbus had the disease himself when he landed the second time. From there it is believed to have been spread to other portions of the earth in the old wooden ships which afforded an ideal hiding place for the mosquitoes that harbored the disease-giving organism."

At the close of the Spanish-American War in 1898, Cuba became a ward of the United States, and in the following year the dreaded yellow fever broke out among the American troops stationed there. A commission composed of Major Walter Reed, Dr. James Carroll, Dr. J. W. Lazear and Aristides Agramonte were appointed to look into its cause and transmission.

Like many great discoveries, this one was not made all at once or by one man. Dr. Carlos H. Finley, twenty years before, had advanced the idea that the disease was transmitted by mosquitoes. Major Reed determined to test out this theory, and the only way to do this was to use human beings to try it out on, as animals appeared to be immune. Volunteers were called for and the commission offered themselves too. Every man knew he was likely to die.

Two young soldiers, Privates John R. Kissinger and John J. Moran, offered their services. Dr. Reed talked with them and told them the danger and suffering involved and said that a money compensation would be made them if the experiment was successful. The soldiers declined the reward, and Major Reed touched his cap and said, "Gentlemen, I salute you." He wrote later in his published account of the experiment: "In my opinion this exhibition of moral courage has never been surpassed in the annals of the Army of the United States."

The volunteers permitted themselves to be bitten by mosquitoes that had stung yellow fever patients. Dr. Lazear became ill with fever and died in convulsions. Dr. Carroll almost died, and for three days his life hung in the balance. The experiment was tried on eleven other men and nine of them came down with yellow fever.

There were some who did not think this was definite proof. A lonely hut was constructed, far away from habitations and divided into two parts by wire screens.

The entire building was also covered with screens. Two susceptible men were put into this house, one in each compartment, and were thus subjected to the same conditions. Both lived there a while and remained perfectly healthy, showing there was no infection. Then Major Reed let fifteen infected mosquitoes fly into one of the compartments. The man in the mosquito-infested compartment was bitten fifteen times. In four days this man had yellow fever and the other one separated from him only by a screen remained perfectly well.

The mosquitoes were removed and soldiers were placed in each compartment. They remained well. There were still sceptics who claimed that infection might yet be by contact. Major Reed devised conditions which absolutely disproved this theory and showed that only by direct injection of blood from a yellow fever patient, or by an infected mosquito bite, which he said was the same thing.

Once the cause was known, it was possible to stamp out the disease. The effect of this event on history and world progress has been revolutionary. The Panama Canal became a possibility and shorter trade routes were open to all the ships of the world. Plague ridden ports of Latin America were cleaned up and large areas were made habitable. Some archeologists see in yellow fever the cause of the downfall of prehistoric American civilizations. There are those who see a new era of progress for Latin America now that the plague of yellow fever has been removed.

THE LONDON PREHISTORIC SKULL

A LEFT-HANDED lady at least 20,000 years old is attracting more attention in London than any young debutante. Part of the broken skull of this prehistoric inhabitant was found in the heart of the city in the course of deep excavations for an office building. Professor G. Elliot Smith, who has examined it carefully, has expressed the opinion that the woman belonged to the late stone age, and she is therefore the oldest Londoner and the second oldest British resident so far discovered.

One of the most interesting characteristics of the stone age Londoner is her left-handedness, which is indicated by the greater development of the right side of the brain. Six per cent. of the population to-day is left-handed and anthropologists think it likely that a similar condition extended back into the past indefinitely. Probably the prehistoric woman had the same difficulties in managing stone age tools and household equipment that modern left-handers have with right-hand telephones, door knobs and coat buttons.

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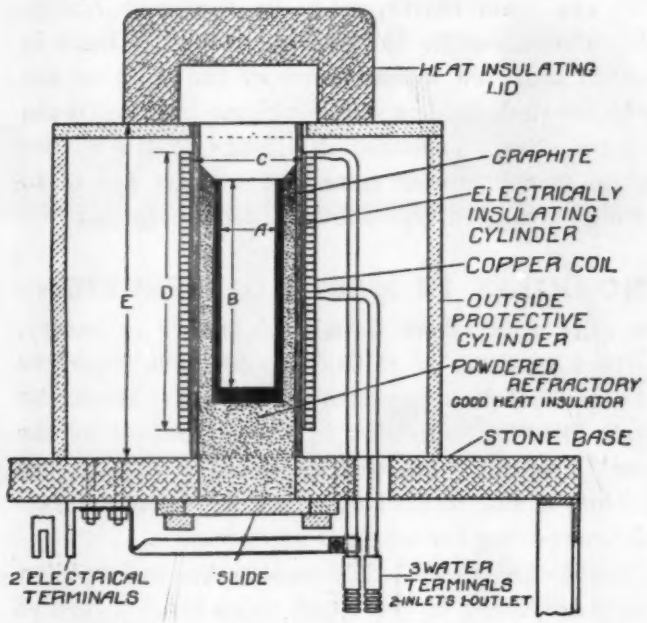

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The evidence indicates that the skull is very old. A fine Roman pavement had been discovered in the same locality a few feet below the ground surface. But the skull lay in blue clay under 40 feet of earth, far below relics of Roman occupation. The leg bone of a wooly rhinoceros was found at the same depth. And both above and below the skull level were bones of a mammoth.

The skull's antiquity is further shown by its fossilized condition, and the edges of the fractures indicate that it was broken in ancient times, possibly before it was deposited in the fossil beds of the Pleistocene gravel. There seems little doubt that the skull, like the animal bones, were carried to the site by floods coming from somewhat farther up the Thames.

The intelligence of the prehistoric woman is in dispute. A cast of the brain cavity, made by Professor Smith, shows that she was quite flat headed, and while there is no likelihood that the woman lived so far back as the Neanderthal period, experts who have examined her brain are not agreed as to whether it belongs to the earlier Neanderthal model popular some 50,000 years ago or to the later higher browed type known as *Homo sapiens.*

EOSINOPHILES IN MASTOID INFECTION

BLOOD cells which flash signals of danger or safety, as important as those of railway semaphores, form the basis of a medical discovery made at Spokane, Wash., by Miss Viola Brewer, technician in the laboratory of the Deaconess' Hospital. The young woman's research has given doctors a new method of sizing up mastoid infection and determining the need for an operation.

Miss Brewer has succeeded in taming the eosinophiles, those white corpuscles in the blood which become reddish on contact with the stain employed in making blood counts. Her discovery came about in connection with her laboratory work, in which blood counts were a part of the daily routine. The results of daily tests in mastoid infections centered her attention on the circumstance that subsiding infection is always indicated by a change in the character of the patient's blood test.

Through careful study and comparison, Miss Brewer demonstrated that severe infection causes disappearance of the eosinophile corpuscles in the blood of the patient. With improved conditions these corpuscles reappear in normal abundance. Frequent tests in individual cases showed that there was uniformity in the disappearance and reappearance of the eosinophiles. Close study showed that the changes were in exact harmony with the bedside record of clinical symptoms, including pain, swelling and temperature. In temperatures ranging from 98 to 100 the percentage of eosinophiles was at its maximum. By pursuing the comparisons the technician became convinced that the corpuscles could be made valuable aids to physicians on watch.

When research had established consistent activity of eosinophile action and clinical symptoms, Miss Brewer submitted a detailed report to her laboratory chief. This report has been accepted for scientific publication. Ear specialists in Spokane are employing the method in regular practice. They state that it is a valuable guide to treatment, and that the signals are important in determining the need for use of the knife.

NO "LOST CONTINENT" IN PACIFIC OCEAN

"LEMURIA," "Mu," and all the other hypothetical vast land areas forming "lost" Pacific continents, like the lost Atlantics of ancient European imagination, receive no credence on the part of Dr. Francis Xavier Schaffer, noted geologist of Vienna, now traveling in the Pacific area and the Orient. Dr. Schaffer is backed up in his opinions also by the scientists at the Bernice P. Bishop Museum of Honolulu.

Though no land areas of continental size ever existed in the Pacific, Dr. Schaffer stated, there are regions or movable zones where emergence and submergence are constantly in progress.

"Such a line," he said, "goes all around the Pacific and connects the Antarctic continent with the continents of the southern hemisphere. It is easy, too, to see that the northern continents may more than once have been connected by way of the Bering Strait and by the rising of the relatively shallow sea bottom between Greenland and Europe."

Dr. Herbert E. Gregory, director of the Bishop Museum, disagrees with the theory advanced by Dr. J. Macmillan Brown, chancellor of the University of New Zealand, who claims that the Pacific islands are the remnants of a once great empire that collapsed into the ocean in a series of cataclysms.

"Geological evidence," said Dr. Gregory, "gives no proof that there ever was a large area of land in the central Pacific. No rock has been found which could be considered part of an old continent. The only way that geologists will ever be able to make a real test of these theories will be by an extensive system of borings which must extend through the coral and the comparatively new levels of the islands, and also by a carefully planned sounding of the Pacific Ocean."

"The lost continent theory can not be substantiated by botanical discoveries," said Dr. Forest B. H. Brown, botanist of the Bishop Museum. "In the Hawaiian Islands, for instance, over 80 per cent. of the plants with net-veined leaves occur nowhere else in the world. Had Hawaii been a part of a continent of which the other Pacific islands were also parts, one would expect more plants in common to all."

ITEMS

THE stir caused some two months ago by the alleged discovery by a French Government vessel that the floor of the Bay of Biscay had undergone a sudden upheaval and that, in place of the abyss marked on the marine charts, there was now a comparatively shallow plateau, seems to have been a hoax. A special survey ship of the French Government, the *Gaston-Rivier,* was sent out to check the soundings reported, and Dr. Charcot's scientific ship, the *Pourquoi-Pas,* collaborated in the work. After the most thorough investigation it was found that the bottom of the Bay of Biscay had not changed in any way since the charts in general use were made.

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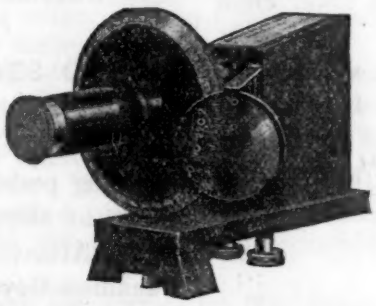

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SCIENCE NEWS

Science Service, Washington, D. C.

SCIENTIFIC WORK OF THE "MAUD"

TIDAL observations made during the long three years' stay of the *Maud*, Captain Roald Amundsen's ship, in Arctic ice north of Siberia indicate that there is no Arctic continent or land mass in the great unexplored area between Alaska and the North Pole. This was pointed out by Dr. Harald U. Sverdrup, in charge of the scientific work of the expedition, in a lecture to the Carnegie Institution of Washington.

Using an electrical recording current-meter designed and constructed on board the ship, Dr. Sverdrup made observations at the Bear Islands over a period of fourteen months. He discovered that the tidal wave reaches those islands off the north coast of Siberia in such a way that it "seems to come directly across the Arctic Sea without meeting obstructions formed by land."

The *Maud* left Seattle on June 3, 1922, to penetrate into the drift-ice north of Bering Strait and, if possible, to be carried by it across the Arctic Sea to the vicinity of Spitzbergen, Dr. Sverdrup explained. Closed in by the ice at Wrangle Island on August 8, 1922, the *Maud* drifted for two years west northwest to the region north of the New Siberian Islands. In an attempt to return to Nome, Alaska, in 1924, the vessel was again caught in the ice at the Bear Islands, 800 miles west of Bering Straits, and it was not until August 22, 1925, that Nome was finally reached.

Dr. Sverdrup explained that the principal object of the expedition was to make scientific observations of terrestrial magnetism, weather, the Aurora Borealis, sea depth, temperature and air currents. By means of small balloons the air currents of the upper part of the atmosphere over the Arctic were studied. The temperature of the air from the ice to an altitude of about 6,000 feet was studied directly by recording instruments lifted by kites. The most interesting result of these observations is that the temperature in winter is always lower close to the ice than at an altitude of 1,000 feet. The lowest temperature is found at the ice during calm weather.

The lowest natural temperature that can be attained in the region visited by the *Maud* is minus 50 degrees Fahrenheit which indicated that the heat lost to the upper air and gained from the warmer sea water below would equalize at that temperature.

IDENTICAL TWINS

ARE you left-handed? Does the hair whorl on top of your head turn from right to left? These, with other points, may indicate that you are one of a pair of identical twins, even though you were born alone, according to Professor Horatio Hackett Newman, biologist at the University of Chicago, who for many years has conducted research into the causes and modes of twinning.

Identical twins are two halves of one person: the right and left components of an originally single individual, which very early in its growth abnormally split into two equal parts, each part reorganizing itself and growing into separate, complete persons. Obviously such twins are exactly alike in heredity, appearance and sex, and are the type of twins who cause so much confusion among their friends, because they "can't tell them apart."

These twins are identical with this difference—each is the mirror image or image reversed of the other in certain parts of the body. It has been noted that one of the pair is naturally right-handed, the other left-handed, unless trained otherwise. In one the hair whorl on the head turns clockwise, that is, from left to right, in the other the whorl turns counter-clockwise, from right to left. The whorls of the finger prints are identical except that in one the curves of the whorl turn clockwise, in the other counter-clockwise.

Growth conditions frequently do not favor the two equally before birth, consequently one dies very early in its development (or as happens more rarely, is absorbed into the growing body of the other) leaving the other twin to make its appearance in the world alone. Such is the explanation of the solitary left-handed individual.

This early splitting of the growing germ cell is an unnatural condition caused, according to Professor Newman, by a slowing up or pause in the rate of growth at a critical period. When normal developmental conditions return, the single original growing point is so weakened that often two new points at equal distances from the original point arise, and these form antagonistic growing points, which split the organism apart, forming thus two separate embryos. Sometimes this separation is incomplete and the so-called Siamese twins are formed.

The other type of twins, fraternal twins, are always formed from two germ cells that happen to be fertilized at the same time. They develop normally into two individuals who are not alike in heredity or appearance and often are not of the same sex. They were born at the same time, and there the similarity ends.

COLD STORAGE METHODS IN CANADA

IMPROVEMENTS in refrigeration methods which may result in wide-spread changes in systems of storing and shipping perishable foods are being put into effect by a group of shipping experts, fish distributors and officials of the Atlantic Experimental Station for Fisheries of the Canadian Government.

The central idea of the new method is that foods preserved by freezing should be chilled rapidly instead of slowly, as has been the practice in the past. Filets of large fish are wrapped in waxed paper and packed tightly in narrow cans, sunk in a rapidly circulating bath of very cold brine, kept constantly at a temperature near zero Fahrenheit. Small fish are wrapped and packed in whole. This process freezes the fish rapidly, preventing the formation of large ice crystals which occurs when the chilling proceeds at a slower rate, and which is very deleterious to the fish when kept for more than a few

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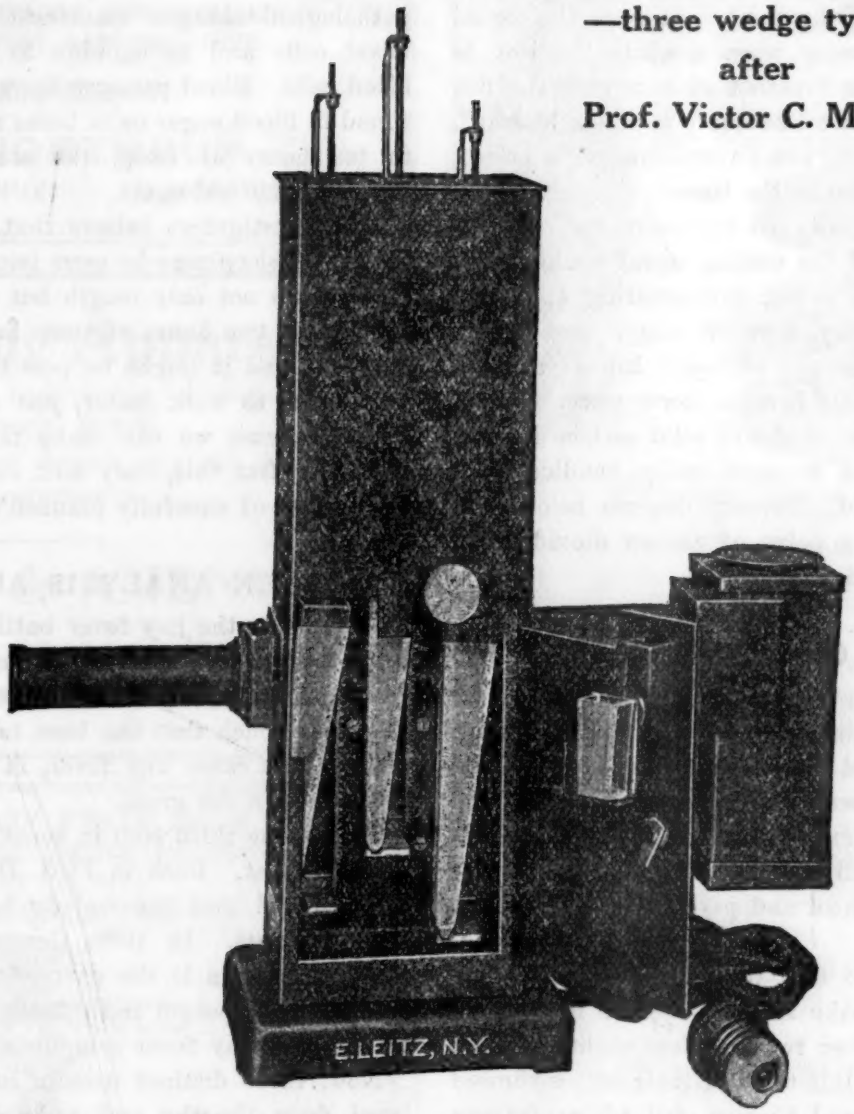

It is primarily constructed for the colorimetric determination of hydrogen ion concentration in various biological fluids such as urine, gastric contents, blood, bacteriological culture media, etc., and the "Marriott" alveolar carbon dioxide test.

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days. Fish preserved by the new rapid-freezing method have been kept for six months, and when thawed and cooked could not be distinguished from freshly caught fish.

Still more rapid methods of freezing are being sought by the experimenters. Pieces of haddock were hung on wires and submerged in liquid air, and kept in big thermos bottles, which furnished a temperature of some 300 degrees below zero Fahrenheit. At once the liquid boiled and hissed like water when a white hot iron is plunged into it, and in a fraction of a minute the fish was taken out, frozen white like one's ear in a blizzard, and brittle as taffy. There was no moisture on the flesh, no slime, no crystals of ice in the tissue.

Liquid air freezing is still too expensive for commercial use, but the price of the cooling agent could be reduced to a few cents a quart, refrigerating engineers claim, if the fish industry were to adopt the technic widely, since the manufacture of liquid air on a large scale for this purpose would bring a lower price.

The use is being considered also of solid carbon dioxide, the soda-water gas which is more easily handled than liquid air but not so cold. Seventy degrees below zero Fahrenheit is the melting point of carbon dioxide, and like liquid air it gives a dry, pure cold.

THE EFFECTS OF LOSS OF SLEEP

AFTER staying awake two nights in succession, an individual may still be captain of his muscles and reasoning powers, but his eyes and ears may begin to play him queer tricks. This is shown in the scientific report of the sixty-hours-without-sleep experiment at George Washington University, which will shortly be published by professors of the medical school and psychology department who conducted the tests.

The eight students who took part in the insomnia experiment were able to make as good records in tests of their mental alertness after two sleepless nights as they made at the beginning. But tests of their senses showed that efficiency of sight and hearing fell off as fatigue increased.

In addition, one student reported that after forty hours of wakefulness he happened to be on the street at night and clearly saw a man watering some plants, though he realized at the time that no one would try to stand on the narrow ledge where the phantom appeared. This illusion and others similar to it turned into posts, flowers and other familiar objects when the student approached them, but the illusions continued to trouble him, even in full daylight. Another subject reported similar disturbances of vision from the vigil.

A number of practical tests connected with automobiles were tried out on the subjects of the experiment. The report states that students were able to park automobiles in small space dextrously after two nights of wakefulness. But when they tried driving along a road, effects of fatigue became evident.

Dr. F. A. Moss, who directed these tests, says: "It seems that so far as short operations are concerned, efficiency is not decreased by prolonged periods of wakefulness, but continuous driving is far from a safe undertaking after 35 or 40 hours of wakefulness. Driving ability is little affected by the lack of sleep, but the monotony and rhythm of the moving car are likely to dull the wits of the subject and induce sleep in spite of his determination to keep awake."

The medical investigators, who tested the physical condition of the students, reported that loss of sleep caused pathological changes manifested by a decrease in red blood cells and hemoglobin and an increase in white blood cells. Blood pressure decreased, but no change was found in blood sugar or in basal metabolism. After eight to ten hours of sleep, the students were pronounced physically normal again.

The investigators believe that, just as with food, the quality of sleep may be more important than the amount. "Sleep has not only length but depth," they point out. "The first two hours of sleep are much deeper than the last two, and it might be possible to cause the sleeping mechanism to work faster, just as by a series of conditioned reflexes we can make the salivary glands work faster." But this, they add, could only be determined by a series of carefully planned experiments.

POLLEN ANALYSIS AND HAY FEVER

JUST when the hay fever battle of 1925 is over comes news that may enable hay fever fighters to attack the enemy at somewhat closer range in the next encounter. The new trench that has been taken is analysis of grass pollens that cause hay fever, in order to isolate protein substances in the grass.

This is the third step in conquest of hay fever by pollen treatment. Back in 1865, Dr. Blackley, an Englishman, proved that the malady was caused by pollen of certain plants. In 1902, German investigators showed that the protein is the part of the pollen grains which has power to poison individuals, causing the result that we know as hay fever symptoms.

Now, three distinct protein substances have been isolated from timothy and orchard grass pollen, and the power of these chemically pure substances to cause hay fever symptoms has been tested. Results of this work are reported by Drs. D. B. Jones and F. A. Csonka, of the U. S. Protein Laboratory, and by Dr. H. S. Bernton, associate professor of hygiene and preventive medicine at Georgetown University.

In their tests, the three investigators found that all hay fever sufferers who had the summer type of hay fever caused by timothy and other grasses were affected by the first of the isolated substances, protein A. Fifty per cent. of the hay fever victims were also sensitive to protein B, the second substance. Protein C was negligible. No one was affected by it in the experiments.

Dr. Bernton states that he believes these findings may lead to progress in pollen treatment of hay fever. "Instead of immunizing patients by injecting pollen extract, we may be able to give them directly suitable doses of the different proteins, and immunize them in that way," he says. "Investigators have had from five to sixteen per cent. of failures in treating subjects with pollen, and

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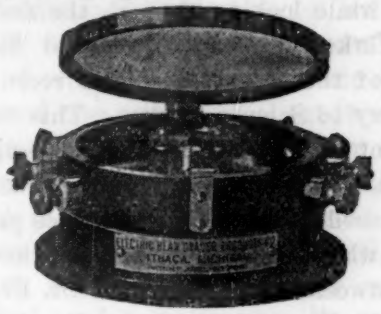

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I believe that some of these failures at least are due to the fact that patients are sensitive to both A and B proteins and do not get enough of protein B, which is present in much smaller quantities than protein A in the hay fever pollens which we have tested.''

A NEW COMET

A NEWCOMER to the vicinity of the earth in the form of a hitherto unknown comet was discovered at 5 A. M., Tuesday, November 17, by Professor George Van Biesbroeck at Yerkes Observatory.

Professor Van Biesbroeck located the new heavenly object while looking through the finder of the large 40-inch Yerkes telescope, Professor Edwin E. Frost, director of the observatory, said recently in reporting the discovery to Science Service. This finder is a smaller instrument attached to the big telescope and it is used to cover a larger field of the sky. The comet which had a pronounced tail was near the place predicted for Orkisz's comet, which was not visible, but there can be no connection between the objects, said Dr. Frost, for immediately after its discovery Professor Frank Ross made a photograph which showed both.

The position of the comet is given as right ascension 11 hours, 56 minutes, 33 seconds and declination 34 degrees, 55 minutes north of the equator. This is in the constellation of Canes Venatici, or the Hunting Dogs, which can be seen high in the eastern sky just before sunrise, but the comet is slowly moving to the southeast and entering the neighboring group of Coma Berenices, or ''Berenices's Hair.''

Until it is known just how the comet is moving, astronomers can not tell whether or not it will become visible to the unaided eye. An exact determination of its orbit will be possible when two more observations of its position are made. It is now of the ninth magnitude.

ITEMS

THE shoal in the Atlantic Ocean off Cape Hatteras reported by several merchant vessels has not been confirmed by a vessel of the navy sent to check up on the reports, according to Captain W. S. Crosley, chief hydrographer of the U. S. Navy. A radio message has just been received from the survey steamer *Nokomis* now on the way to Cuba for the regular survey season, which stated that on November 19 they spent seven hours in the region of the reported shoal but failed to find it.

BY interpretation of data telegraphed Science Service from the seismograph station of the U. S. Coast and Geodetic Survey at Tucson, Arizona, earthquake experts of the survey at Washington find that a mild earthquake occurred within 150 miles of Tucson at 11:04 A. M., eastern standard time, on Thursday, November 19. As no reports have been received from other seismograph stations, the exact center can not be determiend. Another report from Harvard University, of a quake which occurred at 11:21 A. M., eastern standard time, on the same day, was within 420 miles from Boston, which had no connection with the Arizona one, said Commander N. H. Heck, in charge of the survey's seismographical investigations.

RADIO has come into the field as a means of spreading the use of Esperanto, the language designed for international use. The Esperantists of Europe have long seen in the new method of communication the best possible agency for popularizing their language. With the cooperation of Radio-Paris, one of the principal French broadcasting stations, the new tongue is to be given voice by wireless for the purpose of gaining Esperanto recruits among the millions of European radio fans. In Europe, unlike the United States, there is great confusion of tongues for the listener-in. The countries are densely crowded and a single message will have an audience made up of the users of a score of languages. This condition has given the Esperantists their opportunity. Through the agency of Radio-Paris a series of fourteen lessons in the universal language are being broadcast, and a prize of 1,000 francs has been offered for the best Esperanto student among listeners-in.

THE geological fault that caused the Montana earthquake of June 27 and 28 will be the object of a search by a government geologist, J. T. Pardee, sent out by the U. S. Geological Survey. Mr. Pardee is now on his way to Three Forks, Montana, whence he will start his expedition into the mountains, to learn if possible which of several known faults slipped and caused the quake. Mr. Pardee is a specialist on the geology of the northern Rocky Mountain region. Officials of the Geological Survey state that they do not expect to send any investigators into the southern California field because of the presence there of a number of geologists who are already at work on the source of the Santa Barbara quake.

THERE is no longer any need to crawl under the house with paper and kindling wood to thaw out the frozen water pipes, and risk burning the house down or suffocating. A German electrician suggests a means of thawing them out with electricity. The ordinary house current is reduced to a voltage that is not excessive by means of a transformer, and then it is sent through the frozen section of the water pipe. The heat produced by the current will melt the ice.

MOSQUITO ''wigglers,'' or larvae, are not smothered by the oil sprayed on their pools; they simply drown. The researches of Dr. David Keilin, working at the Molteno Institute in South Africa, and recently announced by Sir Arthur E. Shipley, run counter to the older and commonly accepted notion. Mosquitoes and their larvae, like all insects, have no lungs or gills to breathe with, such as higher animals have. They get the oxygen they require through systems of tubes opening directly to the outside air and branching inward to all parts of their bodies. Dr. Keilin discovered that mosquito larvae had certain cells in these tubes that secreted a fatty substance, which served to keep the water out. But upon experimenting with them, using oil, chloroform, strong alcohol and other liquids that dissolve fats, he found that if these protective secretions were thus dissolved, the breathing tubes of the larvae filled up with water, and the hapless ''wigglers'' drowned.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE REDUCTION OF HIGH BLOOD PRESSURE

HIGH blood pressure is reduced by substances produced in the liver, and extracted as a highly concentrated and potent compound by a Canadian physician, Dr. W. M. MacDonald, of St. Catharines, Ontario. Recently Dr. MacDonald discovered the value of a cruder form of the extract, and made a preliminary announcement of the fact. Since then he has been working on methods of purification and refinement, and made his report before a recent meeting of the Toronto Academy of Medicine.

The results which have been obtained in experimental animals with the liver extract and preliminary chemical analysis of the potent material have shown that the active principle is similar in character and action to certain ammonia-like substances already known to be capable of lowering the blood pressure. The great differences between the new material and the old lie in the size of the necessary dose and in the duration of the effects. To produce a given diminution of pressure, incomparably smaller quantities of the new material are needed than of histamine or choline, two of the most active of the older chemicals.

Further, the liver extracts produce effects which persist for several hours. All preparations which had been tried before Dr. MacDonald drew attention to liver extract had only a temporary effect and therefore gave little promise of furnishing a weapon for attacking the ailment in human beings.

Describing his earliest experiments on rabbits, Dr. MacDonald told of the injection of liver extract into the jugular vein of twenty-eight animals. At this stage, there was no clue as to the proper dose, and the treatment proved so drastic that the blood pressure of twenty-one of the rabbits was reduced to zero, and they died. Of the remainder five showed a long and decided fall and in the case of two there was no appreciable alteration. Still more significant results were obtained in the case of dogs and cats, where practically without exception a drop in blood pressure occurred when the extract was administered. Cats and dogs are being used for all the animal experiments at the present time.

Of vital importance from the point of view of the safety of the preparations was the statement by Dr. MacDonald that the lethal dose is definite and can be ascertained. "The effect appears to be in direct proportion to the weight of the animal and to the amount administered; the lethal dose can be definitely established."

In his experiments animals were given doses of proper strength at frequent intervals, in order to show whether there was any unfavorable cumulative action. No such ill results could be detected. Dr. MacDonald said that both the toxicity tests on laboratory animals and the effects of the extracts on the isolated heart, have not revealed any unfavorable action which would contradict their repeated injection into man. Repeated injections at intervals of several days have not brought out any anaphylactic-like reactions.

Dr. MacDonald stated that a yardstick has now been obtained by which to measure the potency of liver extracts. This is done by standardization against histamine, which can be prepared pure in the laboratory. Two methods have been perfected already, one of which consists in the comparison of liver extract and histamine by injection into an animal on which a blood pressure tracing is being made; the other method consists in making use of the power possessed by both extract and histamine to cause contractions in certain of the involuntary muscles.

THE USE OF GLANDULAR EXTRACT IN THE HEALING OF FRACTURES

BROKEN bones can be cured through the use of a new glandular extract that has already proved its usefulness in curing tetanus. This is the information coming from Japan where experiments have been in progress with the hormone of the parathyroids that was isolated last year by Professor J. B. Collip, of the University of Alberta, Edmonton, Canada.

Professor Collip obtained from the parathyroid glands a hormone or extract which, when injected or given by the mouth, causes the amounts both of calcium and phosphate in the blood serum to rise. The parathyroids are four very small glands in the neck which lie near the thyroid gland or are embedded in it. His discovery was applied successfully to the cure of tetany, a somewhat rare disease usually found in children, and characterized by peculiar spasms.

A much wider utility for it is foreshadowed by the work done subsequently by Dr. Ogawa, in the surgical clinic of the Japanese medical academy of Keijo. As bone is so largely composed of calcium phosphate, a hormone which raises the amount of this substance in the blood might be expected to assist in bone formation. Rats with broken legs were found to produce twice as much new bone when fed with parathyroid glands as when not so fed.

Bone consists largely of calcium phosphate, and after a fracture fresh quantities of this substance must be taken from the blood for the formation of new bone. The slowness of the healing process seems to be largely due to the very small amounts of calcium and phosphorus in the blood.

The publication of the results in the case of human beings is awaited with the greatest interest, for there is reason to believe that the administration of parathyroid extract would not only hasten the healing of fractures in the young, but might render it possible in old age.

THE DETERMINATION OF SEX

X-RAY treatment of the prospective father of a brood of animals before mating will influence the proportion of males and females among his offspring. If the mating

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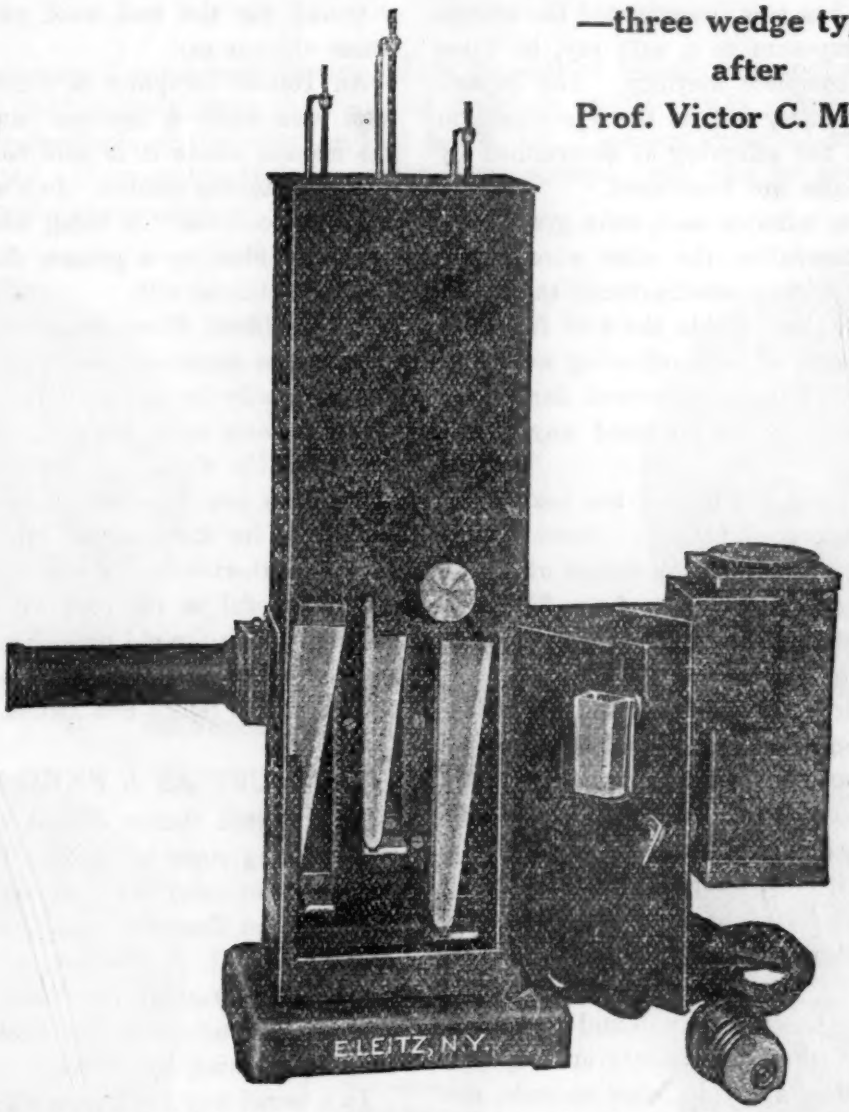

It is primarily constructed for the colorimetric determination of hydrogen ion concentration in various biological fluids such as urine, gastric contents, blood, bacteriological culture media, etc., and the "Marriott" alveolar carbon dioxide test.

As ordinarily carried out these determinations are cumbersome and rather crude, since it has been necessary to employ a series of tubes with graduated pH values as standards, owing to the fact that here one is dealing with combinations of two colors instead of a single color.

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is made within a few days after the treatment there will be more males; if it is delayed for a week or two there will be more females. These results were obtained by A. S. Parkes, of the University of London, working on mice.

It has been known for many years that prolonged exposure to X-rays produces sterility, both in man and animals. But no diminution of the sex instincts follows in such cases. Mr. Parkes has now investigated the effects on breeding power of exposure to a soft ray, in doses insufficient to produce complete sterility. The experiments were conducted on mice, and, as there is reason to suppose that the sex of the offspring is determined by the male parent, only males are irradiated.

Three exposures of ten minutes each were given, and at determined periods thereafter the mice were mated with normal females. It was repeatedly found that from matings which had taken place within the first few days after exposure a large excess of male offspring were produced. Only two out of 11 litters conceived during the first three days after irradiation produced any excess of females.

Among the offspring conceived during the next week, however, females preponderated heavily. Seven litters were obtained, not one of which had an excess of males. The remaining births, conceived within from 25 to 58 days after irradiation, showed nothing very striking as regards the proportions of the sexes.

Seven hundred and thirty-five normal mice, bred under conditions similar to those in which the experimental matings were made, gave a male percentage of 51.6 in their offspring. Young conceived from irradiated male parents within four days of the date of the exposure gave a male percentage of 59.4, whereas among offspring conceived during the next fortnight after irradiation the percentage of males fell to the remarkably low figure of 33.6.

No satisfactory theory has yet been found to explain these curious results. Further experiments are expected to show to what extent they apply to other animals, and whether or not they will be worthy of the attention of the animal breeder.

"WOOL" FABRIC MADE FROM WOOD

A NEW yarn, with the warm soft feel of lamb's wool, is now being made from the waste product of the artificial silk industry. U. S. Department of Commerce officials hold out a great future for the new fabric, which is already being manufactured in the United States as well as being imported from Italy, where it started.

The new "wool" is shimmery and dyes in beautiful colors. Combined with real wool in making serge and other goods, it improves its appearance, as silk does. It is not as strong as sheep's wool, and like artificial silk, does not wash as well. This is not a serious drawback for its use in textiles, as only a part of the strength of materials is necessary in clothing.

Chemically, the new yarn is the same as artificial silk, or rayon, for it is either made from its scraps, or directly from cellulose or wood fiber by the identical process. In making of artificial silk, the viscose, or dissolved cellulose, is spun into a continuous thread like real silk from the cocoons of silk worms. The fibers used in the making of this artificial "wool" are short pieces from two to six inches in length, which are worked into yarn like sheep's wool.

The price of the fiber wool yarn will be from fifty cents to a dollar a pound, as compared with two dollars a pound for the real wool yarn, Department of Commerce officials say.

An Italian company is producing this new artificial wool yarn under a German patent and has placed it on the market where it is said to have been favorably received by textile makers. In England a wool-like product called "woolulose" is being manufactured directly from vegetable fiber by a process distinct from that used in making artificial silk.

The artificial fibers resembling wool and silk are the only textile materials that man has added to those provided directly by nature. His cotton grows on bushes, the silk worm spins his silk, the flax plant provides his linen and the sheep and other animals his wool.

But man has improved in one way on nature's textile materials, for these rayon fabrics are more transparent to the ultra-violet or short wavelengths of light which are so helpful in the cure of many diseases. The new fabrics, unlike the old ones, may enable the fully dressed man of a civilized age to get as close to the sun as the savage of the South Sea Island.

SAWDUST AS A FEED FOR DAIRY COWS

THE United States Forest Products Laboratory has been making some interesting experiments with sawdust as a feed for dairy cows. The outcome is doubtful. But down in the Coconino and Tusayan national forests in Arizona, Dr. G. A. Pearson, of the Southwestern Forest Experiment Station, has been making some very conclusive observations of the consumption of young forest trees by grazing livestock.

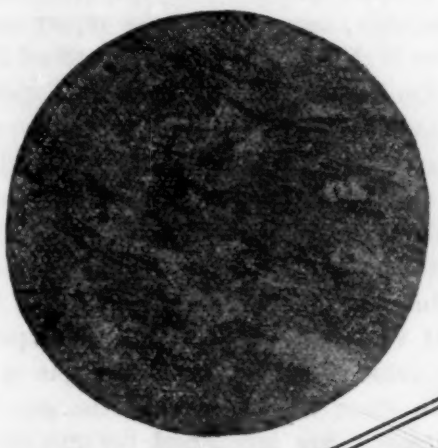
In a broad way Dr. Pearson's conclusions are that stock has eaten up possibly 200,000,000 board feet of potential timber in the last twenty years. This was under restricted grazing privileges. Dr. Pearson finds that there are about 200,000 acres of cut-over land in the two forests on which natural reproduction of trees has failed, wholly or in large part, primarily because of overgrazing. This area is increasing yearly as timber cutting progresses. Most of the damage is caused by sheep and cattle actually eating the pine seedlings. Sheep are the principal offenders, but where the cattle are too numerous they also develop a pine tooth.

Not only has livestock, grazing in the forests under permit, eaten the equivalent of 13,000 lumber houses during the last two decades, but within the last five years it has set back regeneration about twenty years. It appears that on the average it takes twenty years to obtain a satisfactory stand of seedlings in the Arizona pine forests. Seed crops are irregular, and good crops and wet seasons sometimes coincide only once in five years. In 1919, however, there was an exceptionally large yield of

The Silverman Illuminator Gave Satisfactory Results

After All Other Methods of Illumination Had Failed—

Dr. R. Thiessen, Experiment Station, U. S. Bureau of Mines, is responsible for the accompanying photomicrographs showing the structure of the clay in graphite crucibles. After all other methods of illumination had failed, Dr. Thiessen resorted to the Silverman Illuminator. How successful the Illuminator proved itself can be seen from the photomicrographs shown below.



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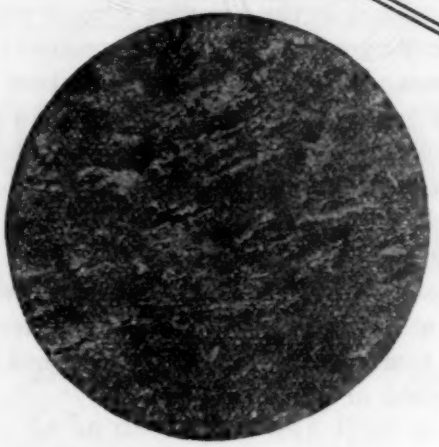
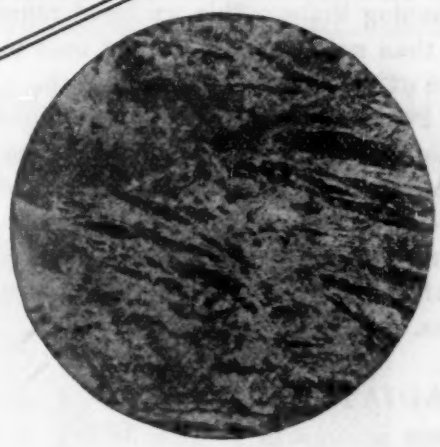


Note how much more detail is revealed in these Photos



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seeds accompanied by the most favorable weather conditions. Millions of vigorous seedlings, even on old cut-over areas with few seed trees, sprang up. Unfortunately, heavier than normal grazing has been permitted of recent years, and 25 per cent. of the 1919 trees have been devoured by cattle and sheep, another 50 per cent. has been devastated and will be eradicated at the present rate of grazing within the next two or three years. Only a quarter of what may be the best seed crop in twenty years has a chance to live.

Grazing has caused great areas of forest land to lie idle for ten to twenty years, says Dr. Pearson. At a net growth of 100 board feet per acre a year, this means the loss of 150,000,000 to 200,000,000 board feet during that time, a loss that is now proceeding at the rate of not less than 15,000,000 a year.

Dr. Pearson calculates that at their present market prices as timber on the stump and forage, trees are worth fifteen times as much an acre for timber as for cattle feed. Converted into lumber on the one hand and into meat on the other, the lumber conversion brings into the community from four to ten times as much wealth as the meat-making process.

Besides reducing the amount of timber reproduction, grazing, Dr. Pearson finds, causes poor quality. To produce good saw timber the young trees must grow close together. Many of them die out in the struggle for light and nutriment, but those that remain are tall, straight and free from lower limbs, whereas without crowding they would have been squatty, crooked and covered with knot-making limbs. This scattered reproduction is often worse than none, because it is at once worthless and preventive of younger and better growth.

Dr. Pearson's investigations have been brought to the attention of the Senate Committee now considering a revision of the administration of public lands, to which the stockmen are appealing for more grazing concessions, and are believed to be contributory to more rigid regulation of grazing hereafter in the Coconino and Tusayan Forests.

RADIATOR CONTROL OF ENGINE OIL

LARGE savings in automobile engine oil can be made with proper operation of the auto radiator. This rather mysterious relation is explained by the National Bureau of Standards and a practical means of taking advantage of the bureau's research discoveries is now suggested.

If the radiator of an engine is too cold the water circulating around the cylinders makes some of the gasoline condense and mix with the lubricating oil. Soon the oil is so diluted that it must be thrown away. To prevent this difficulty the radiator water should be run as hot as possible without boiling; especially it is important to warm up the engine quickly when starting in cold weather.

But with alcohol in the radiator to prevent freezing during cold weather the driver is limited as to how hot he may run the cooling system without danger of losing his anti-freeze material. Every one knows how dangerous it is to boil out the alcohol during a warm spell in the winter, because in the cold wave which follows a freeze-up is likely to occur with the usual disastrous radiator leaks or cracked cylinder block. The latest proposal to get rid of these troubles is to use an anti-freeze material which boils at a higher temperature than water. Numerous such materials have been suggested and certain of these have been tried out with success by commercial fleets of trucks. The two most widely recommended materials are glycerine and ethylene glycol.

THE UTILIZATION OF SEWAGE GAS

CITIES of the future will have their gas works located near their plants for the disposal of sewage wastes, and scientific thrift will recover for fuel a useful gas now wasted into the air. Light and heat from the gas obtained as a by-product in the treatment of sewage is a practicable possibility, according to the report made by the Illinois State Water Survey to the Board of Natural Resources and Conservation of that state. Experiments conducted by the survey indicate that in a city of fifty thousand inhabitants the quantity of combustible gas given off each day by the sewage in the treatment tanks is more than ninety thousand cubic feet.

This gas contains 70 per cent. methane, the chief combustible constituent of natural gas, and has a heating value equivalent to 700 British thermal units per cubic foot, while the value of the common fuel gas is 550 to 600 units. The other constituents of the gas, carbon dioxide and nitrogen, are inert, and the gas itself has no more odor than ordinary fuel gas.

The gas is produced in the digestion process which the sewage liquor undergoes in the Imhoff treatment tanks, and formerly escaped into the air. It has been known for a number of years that this product will burn readily, but city officials and sewage plant operators have not heretofore realized the gross value of the gas that goes to waste each day.

The Illinois State Water Survey, with funds assigned by the Chemical Foundation, is experimenting with the collection and utilization of this gas and is developing a new type of treatment tank which is designed to give the maximum yield of gas.

ITEMS

DEATHS from tetanus may result from the use of bunion pads for shields or dressings after vaccination, is the warning issued by the U. S. Public Health Service, Washington, D. C. Fatalities from this cause have recently been reported from various parts of the country. Not only may the fresh felt pad be contaminated with the lockjaw germs, but the covering of the inoculated spot by any kind of shield will tend to keep the place wet and warm and therefore a favorable culture ground for the growth of microbes, especially the tetanus bacteria. Loose, cool, gauze dressings do not harm if properly cared for, but the best dressing is none at all, in the opinion of the service, for the dry scab that naturally and quickly forms is sufficient protection in most cases, and if the skin has been properly sterilized in advance there is no fear of foreign infection.

WALKER PRIZES IN NATURAL HISTORY

By the provisions of the will of the late Dr. William Johnson Walker, two prizes are annually offered by the **Boston Society of Natural History** for the best memoirs written in the English language, on subjects proposed by a Committee appointed by the Council.

For the best memoir presented a prize of sixty dollars may be awarded; if, however, the memoir be one of marked merit, the amount may be increased to one hundred dollars, at the discretion of the Committee.

For the next best memoir a prize not exceeding fifty dollars may be awarded.

Prizes will not be awarded unless the memoirs presented are of adequate merit.

The competition for these prizes is not restricted, but is open to all. It is nevertheless the tradition of the Society that the founder of these prizes intended them more in the nature of encouragement to younger naturalists than as rewards for the work of mature investigators.

Attention is especially called to the following points:—

1. In all cases the memoirs are to be based on a considerable body of original and unpublished work, accompanied by a general review of the literature of the subject.
2. Anything in the memoir which shall furnish proof of the identity of the author shall be considered as debarring the essay from competition.
3. Although the awards will be based on their intrinsic merits, preference may be given to memoirs bearing evidence of having been prepared with special reference to competition for these prizes.
4. Each memoir must be accompanied by a sealed envelope enclosing the author's name and superscribed with a motto corresponding to one borne by the manuscript, and must be in the hands of the Secretary on or before March 1st of the year for which the prize is offered.
5. The Society assumes no responsibility for publication of manuscripts submitted, and publication should not be made before the Annual Meeting of the Society in May.

SUBJECT FOR 1926:

Any subject in the field of Ornithology

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Any subject in the field of General Zoology.

FRANCIS HARPER, *Acting Secretary.*

BOSTON SOCIETY OF NATURAL HISTORY, **Boston, Mass., U. S. A.** *December, 1925*

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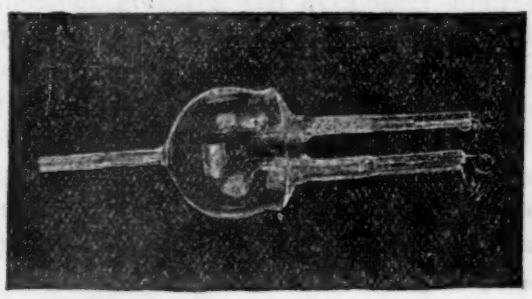

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SCIENCE NEWS

Science Service, Washington, D. C.

NEW THEORY OF LIGHT EMISSION

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A NEW theory of the emission of light, formulated with aid of the Einstein view of time and resulting in amazing conclusions, was announced by Professor Gilbert N. Lewis, of the University of California, who is delivering the annual Silliman lectures at Yale University, New Haven, Conn., this month.

In his lectures Dr. Lewis made a survey of the concepts of science, and he had led up to the relativity theory and its applications. He pointed out that all the formulations of physics have already been re-formulated under the space-time geometry of relativity. The theory of radiant energy has in part resisted such formulation. Dr. Lewis proceeded to demonstrate that, by further extension of the Einstein view of time, it is possible to bring radiation completely into accord with the new geometry.

A new and remarkable concept of the emission of light is necessary, Dr. Lewis contends. The energy of light is corpuscular and the corpuscles act entirely like material particles, nevertheless each particle obeys the laws of the interference of light. Light can never pass to a place where optical theory predicts a dark interference band. Dr. Lewis suggests that atoms do not emit light promiscuously into space but only to other atoms. It is not emission but transmission, in which the emitting atom and the receiving atom play symmetrical and equally important parts.

Dr. Lewis's new theory involves the amazing conclusion that what we do now determines whether certain light particles shall have left a star a thousand years ago although in ordinary parlance the star may meanwhile have disappeared. This seems absurd only because of our habits of using space and time, Dr. Lewis explained.

In relativity geometry the distance between the event of emission and the event of absorption of light is zero. Because of this, Dr. Lewis says: "My eye touches the star not in the same sense but in just as truly a physical sense as my finger touches the table.

"I do not wish to minimize the conflict between this view and that of common sense," Dr. Lewis explained. "The light from a distant star is absorbed by a molecule of chlorophyl in a leaf which has recently been produced in a living plant. We say that the light from the star was on its way toward us a thousand years ago. What rapport can there be between the emitting source and the newly-made molecule of chlorophyl? Suppose by interference we prevent a particle of light from reaching a point. Do we thus prevent its original emission in just that particular direction? If so it means that we can, in a trivial way but nevertheless in principle, alter the course of what we call past events."

As a crucial test of the new theory, Dr. Lewis proposes a simple experiment based upon the pressure and interference of light. If the results of this test prove to be positive it will, like the Michelson-Morley experiment, require a great change in the traditional view of space and time, and further demonstrate the validity of the relativity geometry. The technical formulation of the new theory is embodied in a paper now in publication in the Proceedings of the National Academy.

BLOOD PRESSURE AND LIVER EXTRACT

DR. W. J. MACDONALD, St. Catharines, the Ontario physician who addressed the Toronto Academy of Medicine recently on the use of liver extract in the treatment of high blood pressure, has denied the misappropriation of information from the University of Western Ontario at London, where the claims of Drs. A. A. James and N. B. Laughton to priority has the full endorsement of the staff of the medical school. "I possess documentary evidence in support of my position, which will be available for publication if necessary," Dr. Macdonald declared. The London workers have challenged him to produce the evidence.

All parties are agreed, however, that Dr. Macdonald was the first to use extracts of liver for the treatment of human beings. His opponents claim he copied the methods already in use on animals, and that he was advised to watch for a drop in blood pressure, when he first administered the extract to humans for another purpose. Dr. Macdonald on the other hand asserts that the possibility of using liver extract to reduce hypertension is entirely his own idea.

Professor J. J. R. Macleod, in whose laboratories at the University of Toronto the researches are being continued, stated that Dr. James and Dr. Laughton had lowered blood pressure in animals with both histamine and liver extract when Dr. Macdonald was first associated with them.

The London biochemists are working steadily on the theoretical aspect of depresser substances, disclaiming any desire to "commercialize" their knowledge. Their claim to originality is backed by Dr. A. B. Macallum, professor of biochemistry at McGill University, Montreal, whose reputation is world wide. He said: "Drs. James and Laughton had demonstrated a liver substance capable of lowering blood pressure before Dr. Macdonald went to London to work in October, 1924, when he began another problem which had a futile ending within three weeks, but during which period Dr. Macdonald learned of the effect of this extract on blood pressure."

Dr. Macdonald himself gives "recognition" to the London work. The rival claims will probably be fought out in court. Both parties have applied for Canadian patent rights, and in view of the dual application, a court hearing, with evidence offered under oath if necessary, will take place before either side is given a title.

Officials of Canadian universities who have followed the dispute express disappointment at the attitudes of the two factions, indicating that the altruistic spirit with which a medical discovery should be regarded, has

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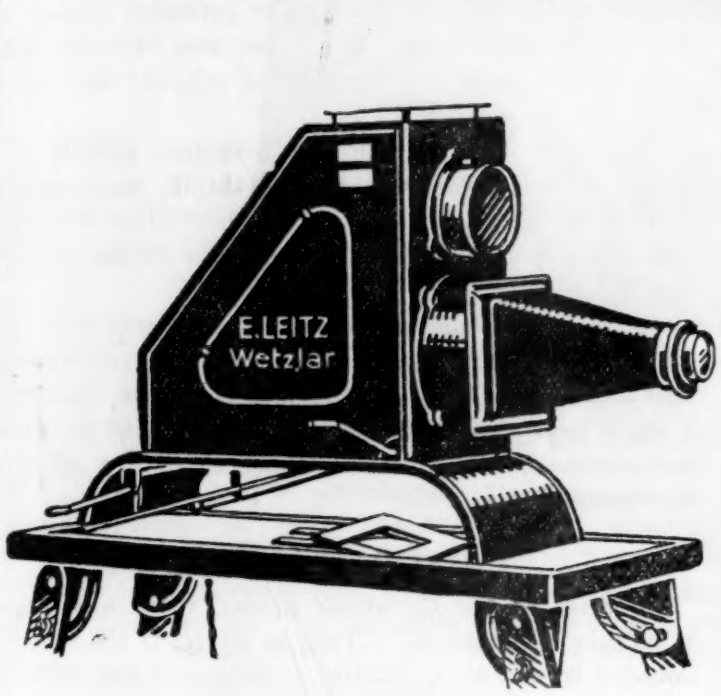

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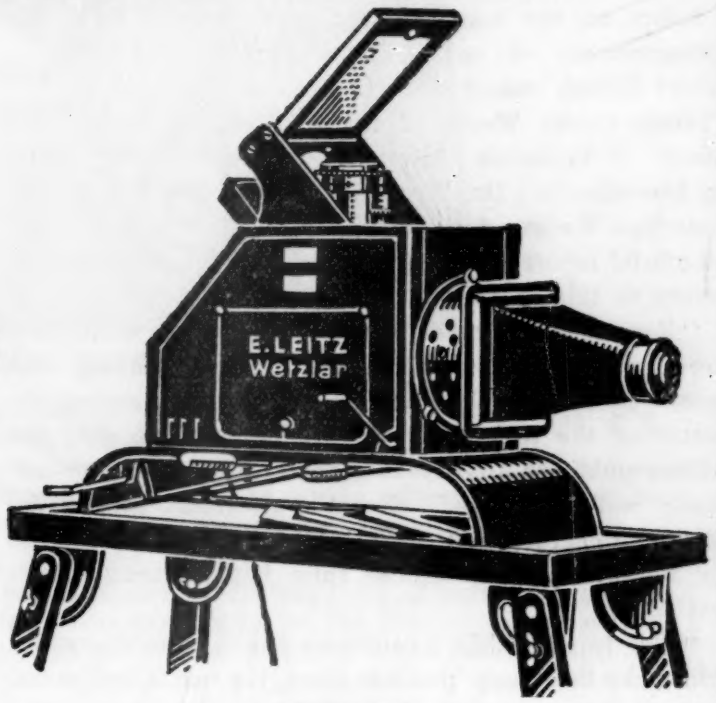

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long since been forgotten. A similar lack of harmony marred a previous important discovery, it is stated.

The incident will have the unfortunate result of cluttering scientific literature, already appalling in its volume and complexity, with the half-considered and unconfirmed conclusions of individuals anxious to ensure priority. Fear is also expressed that cooperation, essential for rapid progress in this field of science, will be entered into with increasing diffidence.

BRITISH CANCER DISCOVERIES

LIGHT on the so-called lead cure, Dr. W. E. Gye's announcement of cancer inoculation tests, and other recent British cancer discoveries is to be sought by Dr. Francis Carter Wood, of the Institute of Cancer Research of Columbia University, who sailed for Europe on December 9. Dr. Wood, who is vice-president of the American Society for the Control of Cancer, will make an official report of his investigation to the society on his return to this country.

"Reports of British cancer discoveries which are arousing so much attention are often misleading and incomplete," said Dr. George A. Soper, managing director of the society. "We are prepared to give the widest publicity to any new facts, providing they are really well established. But the American society deplores premature and sensational announcements made by the press, which arouse false hopes among cancer patients.

"Due to the public's eagerness for information which will make the cancer problem clear, the words and meanings of those who talk about their discoveries are often misconstrued, and the practical value of the work grossly exaggerated. For example, in the case of the Gye and Barnard discoveries the impression seems to have obtained currency that if these gentlemen are right the cure of cancer is in sight. In my conversations with Dr. Gye last summer, he expressly wished it understood that this is far from being his view.

"It is not enough for cancer experiments to be done once. They must be checked carefully. And in many cases the value of the work can be completely established only by numerous independent researches. Some of the recent announcements of the most startling character are by men of high training and ability, but the history of cancer research, as well as experience of hospitals for many years, has shown that even the most careful scientist may be occasionally in error. The public should accept with caution all announcements as to the cause and cure of cancer, and judgment should be suspended until the work reported can be fully confirmed."

A NEW ANESTHETIC GAS

PROPYLENE, one of the constituents of illuminating gas, is being used as an anesthetic in connection with major operations in a hospital in New Orleans. Dr. J. T. Halsey, of Tulane University, reports satisfactory results.

This is a new step in the use of ingredients of common illuminating gas for anesthetic purposes. Ethylene, which belongs to the same chemical family tree as propylene, is already extensively used by dentists and in clinics and hospitals. But propylene is more than twice as potent, so that more oxygen can be administered with it, thus minimizing danger to the patient's breathing.

Butylene and amylene, two other members of the same family, are still more powerful, amylene having fifteen times the strength of ethylene. These two, however, are impractical for hospital use because they arouse marked nervous symptoms, which are not noted in reactions to the weaker gases.

Dr. Lloyd K. Riggs and Harold D. Goulden, of New Brunswick, N. J., who have made extensive studies of propylene with white rats, report that they have tried this gas experimentally on fifteen human subjects who volunteered for the tests.

The higher concentrations of propylene quickly produce unconsciousness. Recovery is rapid, consciousness returns within one minute after administration of propylene is discontinued, and only one of the fifteen subjects was nauseated.

One of the two investigators allowed himself to be put under influence of propylene to the point of unconsciousness three times in one day, without any ill effects except a slight lack of coordination of his muscles which lasted for about fifteen minutes after the return of consciousness.

CHRISTMAS GREENS

Go slow on the Christmas greens, there aren't any "more in the kitchen." This, in effect, is the warning sounded by Dr. P. L. Ricker, president of the National Wild Flower Preservation Society. Unless the present generation extends the principles of conservation to holly and ground pine as well as to the big forest trees, there may not be any of the favorite holiday decorations for their children to enjoy.

A large part of the holly, laurel and other Christmas decorations appearing on the market are gathered by men from the cities who do not own the woods where the bushes grow. That is, these greens are virtually stolen, though the owners may be indifferent to the practice. The greatest danger to our stock of decorative winter plants comes from the careless and destructive methods of collecting employed by these men.

Mr. Ricker recommends that owners of woodlands where winter greens grow should themselves take care of the systematic marketing of their own produce, so that waste may be ended and the profits go where they are lawfully entitled to go. As further conservation measures on the part of the consumer he suggests an increased use of artificial wreaths and garlands and the keeping of live Christmas trees in tubs, so that they may be used year after year. He also recommends the cultivation of potted plants for the same purpose, and especially the cultivation of domestically-grown holly.

THE FORD EXHIBIT AT THE MUSEUM OF THE PEACEFUL ARTS

HENRY FORD has contributed the first exhibit for the Museums of the Peaceful Arts which are to be established in New York City, according to a statement just made

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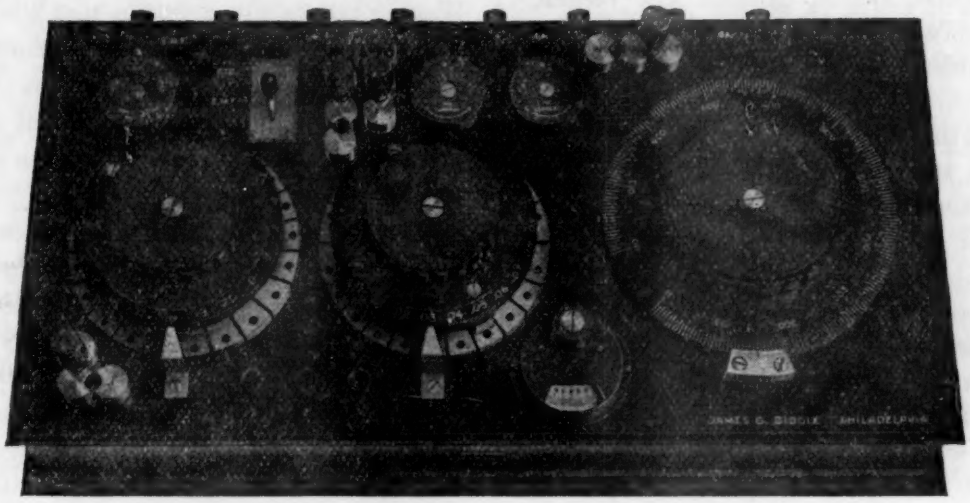

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There are three main operating dials in the potentiometer circuit, the third of which consists of a single turn of slide wire. With this construction any setting on the Potentiometer can be obtained by not more than one turn of each of three dials and very rapid manipulation is possible.

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by Dr. George F. Kunz, president of the association which is establishing the museums. The gift is a set of fine gages running from one hundred thousandths of an inch up to four inches, and is the work of E. C. Johannsen, internationally known as a maker of gages.

"The museums are to be like the great industrial museums of London, Paris, Berlin, Munich and Vienna," Dr. Kunz stated. "They are not to contain single historical machines, which would be interesting only as curiosities, but they are to show the development of the industries and peaceful arts in America, so that young men and women can study the background and trend of the arts they are promoting. It has been said that no single workman in a shoe factory to-day knows how to make an entire shoe.

"There will be permanent exhibits of electricity, astronomy and navigation, steam, safety appliances, mechanical arts, health and hygiene, ceramics, agriculture, printing and books, commerce, roads and architecture. There is to be a library containing books on these subjects. If there had been such a museum for reference in this country during the war, it would have saved the United States billions of dollars."

The museum association has received a gift of $50,000 through the will of Henry R. Towne, of New York.

THE AMERICAN WHEAT CROP

ONE out of every twelve wagon loads of wheat is the annual loss due to illness of the American wheat crop. The U. S. Bureau of Plant Industry has estimated the yearly loss on account of plant diseases of some of the major crops.

The cotton crop pays even more dearly, for the diseases of the cotton plant levy a payment of one bale out of every eight. Nearly one bushel of Irish potatoes is lost out of every five, and over one bushel of sweet potatoes in every six. Diseases of the corn plant cost about one bushel in eleven.

In five years' time from 1919 to 1924, the loss of wheat from plant diseases has dropped from 17 to about 9 per cent. Losses in sweet potatoes have dropped significantly from 36 per cent. in 1919 to less than 18 per cent. in 1922, while cotton crop conditions have fluctuated from a loss of about 14 per cent. to 19 per cent. in this time.

Stem rust is the most serious ailment of wheat and rye, while root and ear rot cause most of the damage in corn. Leaf roll is the most important of the many potato diseases.

The host of diseases which menace certain important crops in the United States present a serious economic problem in American agriculture. Plant diseases, together with insect pests, take a large slice out of the national income yearly.

ITEMS

SOUTH AFRICA is coming into its own as a land of valuable deposits. Added to its diamond and radium mines is the possibility of a large store of platinum. Dr. Percy A. Wagner, of the Geological Survey Office at Pretoria, Africa, reports that discoveries of platinum made in the autumn of 1924 are economically important. Deposits which have been located are of enormous extent, but only a limited area is conclusively proved rich enough in platinum to be profitably exploited. Dr. Wagner points out, however, that the samples which have been taken on the surface or immediately below it may indicate richer ore hidden deeper. "The value of the deposit can not be estimated until a number of shafts are sunk to, say, 20 feet below the surface and samples of the rock systematically taken," he states. The deposits of the Lydenburg District were first discovered by a farmer who was looking for gold. He came upon a few specks of a heavy white metal which looked to him like platinum, and a consulting geologist at Johannesburg confirmed his judgment as to the value of the ore. Geologists say that they have expected to find platinum in this section of the Transvaal, but heretofore the metal has been sought mainly in chromite rock. The platinum fields now under investigation are in the norite zone. Dr. Wagner says that conditions are favorable to cheap mining. A number of mining companies have acquired options over farms of the platinum region, and some prospecting is going on.

No longer need a clothing store salesman take a suit to the window to show the prospective customer the effect in daylight, or even turn on a special light. Instead, he will soon be able to hand the customer a pair of daylight spectacles, which have been invented by Dr. Hermann Weiss, of Vienna. Already they have come into wide use in laboratories in the textile, paper and dye industries, where it is often necessary to judge the color of solutions. They are of blue glass which absorbs some of the yellow rays in which the ordinary incandescent lamp is rich but which are not present in such abundance in sunlight.

THAT the lowly ant is as sensitive to heat and to cold as human beings, and that the ant prefers his temperature not too hot and not too cold, is shown by a report from D. F. Miller and M. Gans, of Ohio State University. A group of ants in going to and from their nest were found to traverse a certain path on the face of a stone. On one side of this path a covered electric light bulb was placed to serve as a source of controlled heat. On the other side was placed a brine coil enclosed in an iron can from which a draught of cold air could be made to cross the path. The closer the source of heat was placed to the path, the more the ants deviated in passing this spot. With the heat turned off and the cold draught operating, the ants again deviated in passing the spot which was cold. The hot rays from the sun were found to be as effective as the artificial heat. At noon when the sun's rays beat directly down upon the path of the ants they sought to avoid the heat by deviating, but finding it impossible to dodge the heat in this manner, they speeded up their travel and simply ran away from the heat.

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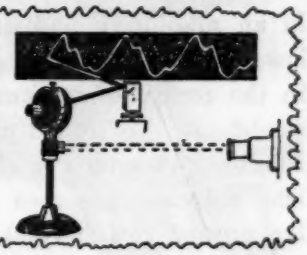

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SCIENCE NEWS

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EXPLORATIONS IN MID-SAHARA

FIFTEEN stone implements, representing one of the oldest of Old Stone Age cultures, found in the midst of the vast emptiness of the Sahara, with no trace of human or animal bones and no sign of the fire-hearth of the ancient camping place—these are the first fruits of our hunt for remains of prehistoric man in the greatest of the world's deserts.

At a spot four miles northeast of Aoulef, we have spent three days excavating an area fifty yards in diameter in the midst of a desert plain between distant remnants of an ancient plateau. According to Professor Gauder, of the University of Algiers, the plain is of Quaternary formation, representing the last geologic period before the coming of the great ice age. At a depth of from two inches to a foot the expedition found a curious sandstone formation with projections like stalagmites, as though a cave had once been there. At a depth of from four to eight inches of sandy clay overlying sandstone, in an absolutely undisturbed deposit, we found fifteen lower Paleolithic implements. The first was a hatchet in the course of workmanship, covered with a crust of sandstone. We found other stone material, all of which has the characteristic shape and technique of the Chellean culture. The men of the Chellean age were of the low-browed Neanderthal race, co-eval with the mammoth and the cave-bear. They knew the use of fire and made chipped flint implements, but had not yet learned to fit these with wooden shafts to make spears and axes.

Soundings and systematic excavations were made elsewhere in the neighborhood, but these implements were all found in a small area ten yards in diameter. There was absolutely no indication of animal remains nor any hearth sites. The place was discovered by Governor Maurice Reygasse purely by chance.

The nearest water was at a depth of thirty feet, irrigating tunnels passing at a distance of one hundred yards from our diggings. The débris in these tunnels does not show any materials similar to our finds.

This discovery constitutes the only lower Paleolithic discovery known in the Sahara. Other stations of later epochs were noted on the surface at a distance, but are as yet unstudied.

The weather is sunny and bright, but wintry. Our arrival at Aoulef Cheurf came at the end of four days' camel-ride across the cold desert. When we reached the place we found that news of our coming had anticipated us, and we were received with all due ceremony by a committee of natives and prominent citizens. They had even turned out a native band in our honor—six drums and one flute. It was a weird noise, but it was the best they had, and we received the salute in the spirit in which it was given.—*Alonzo W. Pond.*

THE MIGRATIONS OF PREHISTORIC MAN

ANTHROPOLOGISTS in America and Europe are interested in data that the Beloit-Sahara expedition under Alonzo W. Pond may supply to fill in an important gap in the map of the migrations of prehistoric man. The results achieved by the Franco-American expedition, in which Dr. Pond participated, together with the preliminary work done in past years by M. Maurice Reygasse, French governor of Tebessa, are looked upon as reasons to hope that the trail of early man, which is now reasonably complete on the northern side of the Mediterranean, may soon be equally complete along its southern shore.

The map of man's migrations has grown in a most remarkable manner during the present year. At the beginning of 1925, the only well-authenticated human remains of the Neanderthal and Cro-Magnon types were those which had been made in southwestern and central Europe. But early last spring a Russian scientist named Bontisch-Osmolovsky discovered in a cave in Crimea parts of two Neanderthaloid skeletons, together with stone implements and bones of prehistoric animals. Then the Mongolian expedition of the American Museum, under Roy Chapman Andrews, reported the discovery in interior Asia of records of the "dune dwellers," who were also men of Neanderthal type. These two discoveries vastly enlarged the known range of this ancient human race, and set the probable center of dispersal well to the east.

A key discovery was made near Capernaum, in Palestine, famed for its Biblical associations, when Francis Turville-Petre, an English paleontologist, found the skull of a Neanderthal man of a peculiar and apparently advanced type. This suggested that the route that took the descendants of Abraham from Asia through Palestine and eventually into Egypt had been traveled long before by this primitive race. Stone age remains of all dates have long been known abundantly from the Nile region. The puzzling skull from Rhodesia, in southern Africa, has some Neanderthaloid features, and may represent a third distinct migration that branched off toward the south.

The question now stands: did the Neanderthal and Cro-Magnon races migrate across northern Africa, at a time when what is now the liteless Sahara supported grassy plains and possibly forests? And did they, upon reaching the Atlantic, complete the circuit of the Mediterranean and cross over into Europe? The "Gibraltar woman" was of the Neanderthal type, and some of the other skulls discovered in the more southerly of the European stations are distinctly negroid. Did the earliest "course of empire" take its way westward in two streams, that reunited at the end of the journey? Scientists are waiting for the answers that are hidden in the sands of the Sahara.

REVERSIBLE PHYSICAL PROCESSES

IN the course of the Silliman Lectures which Professor Gilbert N. Lewis, of the University of California, has been giving at Yale University, he showed that the acceptance of the Einstein theory of relativity abolished the idea of the older physics that the universe is running

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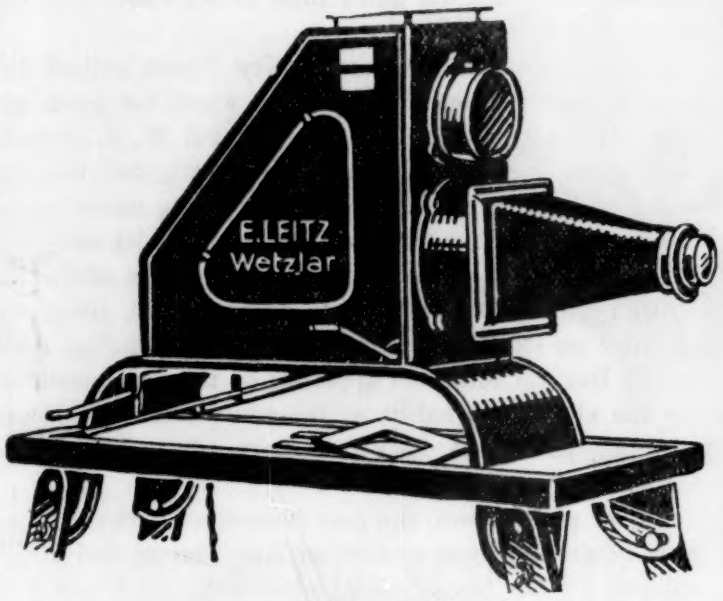

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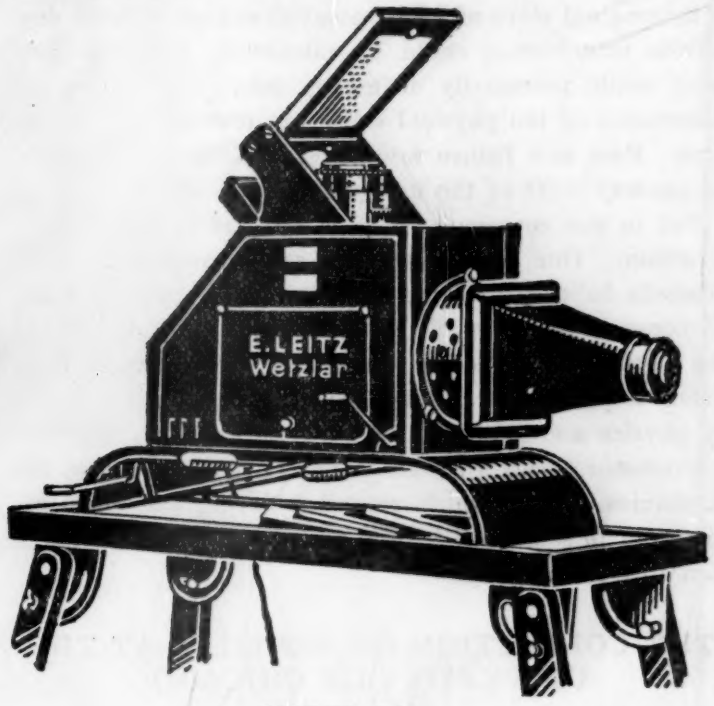

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down like a clock. According to views hitherto held it seemed that all forms of energy tended to become dissipated and eventually diffused throughout space, and this pointed inevitably to a period in the far future when the universe would come to a stand-still forever. Any physical system left to itself would in the long run arrive at this state of run-downness, the degree of which scientists call entropy.

But Professor Lewis pointed out that according to the new geometry of the relativity theory this would not hold true, for the chance that the system would again return to its original state of high potential energy without any outside interference could be calculated, and that this event would necessarily ultimately take place. Thus all phenomena of the physical world are reversible in space-time. Past and future are therefore alike and there is no one-way drift of the universe as a whole.

But in our consciousness time appears to flow in one direction. Our vital processes are irreversible. Life proceeds in one direction from birth to death. Vital phenomena, therefore, do not come under the domain of the physical laws. All irreversible processes result from living things which are cheats in the game being played by physics and chemistry.

Professor Lewis's lecture is regarded as a blow to the mechanism theory which prevailed during the past century and is somewhat in line with the "Creative Evolution" of Henri Bergson.

THE COLLECTION OF REPTILES AT THE UNIVERSITY OF CHICAGO

A CHOICE collection of the brains of an important group of reptiles which flourished in various parts of the world about ten million years ago, and of which the only living representatives are in New Zealand, has been brought to the University of Chicago by Dr. John Cairney, of the University of Otago. He will collaborate with Dr. C. J. Herrick, of the department of anatomy, in making a complete study of the peculiar cranial apparatus.

This lizard, known to the native New Zealanders as the tuatara, and to scientists as Sphenodon, is a stockily built reptile about a foot and a half long. Dr. Herrick states that it is threatened with extinction, a fate which has overtaken some of the flightless birds of New Zealand within historic time. At present its habitat is on some of the smaller outlying islands, where it is being sedulously protected by the government.

The skeleton of the tuatara shows an ancient and primitive pattern which disappeared from the earth millions of years ago except in New Zealand. Why has this pattern survived there? Is it simply because of the absence of dangerous enemies? Or has the creature developed a brain pattern which has outdistanced his old-fashioned body and so enabled him to keep his place in the sun? These are questions Dr. Herrick asks.

"It is too early to predict the results of the examination," said Dr. Herrick. "But clearly the tuatara is not a moron among the lizards. His brains are first class in every respect, and they are very different from those of all other lizards. They are evidently modern brains and no mere survivals of the era of a Lost World marooned on the strand of a desert isle."

THE JAPANESE BEETLE IN NEW HAVEN

MONOPOLY of an undesirable oriental immigrant is the undesired distinction now held by New Haven, a distinction which the city is determined to get rid of at the first opportunity. The immigrant is a little beetle from the orient, an insect related to the Japanese beetle that has wrought havoc among the truck farms of New Jersey and Pennsylvania, and also to the common native American May-beetle. It is, however, considerably smaller than the Japanese beetle and very much smaller than the May-beetle, so that its adult form is not easily detected by the casual searcher.

Several years ago residents of New Haven noticed distressing bare patches in their lawns where the grass was being killed by an unknown enemy. Dr. W. E. Britton, state entomologist of Connecticut, investigated the condition and found that the roots were being eaten by the larvae or grubs; for the new enemy spends its early life underground just as the May-beetle does. The adults, Dr. Britton states, feed very little or not at all, living apparently on stored-up reserves accumulated during grubhood. But the voracious appetites of the grubs make up for the abstemious habits of the adult beetles, and ever-widening patches of dead grass have annoyed the householders of New Haven.

So far as is known, the pest is confined entirely to one area in the residence section of New Haven, and almost entirely to the lawns. One strawberry patch has been ruined, but that is all the damage reported to gardens. If the insect were to spread its range, it might become another major pest; but fortunately it has shown little disposition to wander. This may possibly be due to the fact that although it has wings it appears to do little flying.

During the past summer its depredations have become serious enough to arouse a campaign against it, and heroic measures will be taken this winter to wipe out the colony.

SURGICAL TREATMENT OF TUBERCULOSIS

A SURGICAL method of giving unfortunate tubercular lungs the rest cure is described by Professor John Alexander, of the University of Michigan, in the December issue of the *Journal of the Outdoor Life*, as the means of curing or improving a large percentage of patients suffering from progressive tuberculosis in one lung.

The "rib operation," as this method is called, is the most important surgical means of treating tuberculosis. It was first used in a crude form by a French surgeon of Lausanne, Switzerland, and was greatly improved later in Germany. It has passed the experimental stage and has been used by European surgeons with a remarkable degree of success.

It consists in removing from one to eight inches of the eleven upper ribs where these are joined to the spinal cord. The pleural cavity is not opened and the lung is not touched. The gaps left by the removal of portions of the ribs are filled when the remaining ends come to-

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gether, and the size of the chest is reduced on the operated side, compressing the lung and its cavities.

Within a few months the cut ends of the ribs grow together and bony bridges form between them. The lung loses its power to function and has a chance to eliminate in time the diseased portions. Experience has shown that one healthy lung is enough for the normal respiratory needs of any person.

After the tuberculosis is healed the lung can not be restored. This is not a disadvantage, because the weak lung is held under permanent control against the dangers to which it would be exposed when the patient returns to active life.

After the wound is healed the deformity is very slight. Although the lung is greatly diminished in size the circumference of the chest does not appear much smaller because the collar bone holds the shoulder at its normal distance from the body. The range of motion and the strength of the shoulder and arm on the operated side are very little impaired.

STATISTICS OF MARRIAGE AND DIVORCE

ALTHOUGH the number of divorces in the United States has increased once more and the number of marriages is actually dwindling, according to the U. S. Census Bureau, that is not a sign that the country is fast going to the dogs.

The reason, in the opinion of Dr. Victor C. Vaughan, chairman of the division of medical sciences of the National Research Council, that there are more divorces now is because women are able to support themselves in comfort and peace, and because there are fewer children to hold drifting couples together.

In spite of flappers and jazz, easy divorce and bootlegging, the morality of the country is no worse to-day than it was in the good old days when he was a boy, Dr. Vaughan said. Instead of marrying at all costs, and as soon as possible, a girl to-day does not marry unless she wants to. It is easy enough for her to get a job, and have silk stockings and earrings all her own. The very helpless damsel is passing like the spinning wheel and the highboy.

The figures of the Census Bureau show that in spite of the natural population increase of nearly one and a half million from 1923 to 1924, the number of marriages in that time dropped from 1,223,924 to 1,178,206, or 3.7 per cent., while the number of divorces grew from 165,096 to 170,867.

In 1923 there were 10 divorces for every 74 marriages, but in 1924, the same number of couples got divorced for every 69 marriages. Texas, the biggest state, had the biggest divorce list, and Illinois and Ohio followed after. New York had the most marriages, and Illinois, Pennsylvania and Texas were next.

Divorces in states do not indicate social trends as a rule, but are generally dependent on the nature of the local divorce laws.

ITEMS

AS a replacement for imported black coal the Swedes are this year burning more of their native "white" variety, that is, electricity produced by water power, and remarkable results in fuel saving have also been achieved by an experimental control of coal consumption in 749 institutions owned by the government, as a part of a national campaign to make the country less dependent on foreign raw materials. While practically without either coal mines or oil wells, Sweden has been favored by nature with an ample supply of water power, estimated in a recent governmental report at 42,600,000 kilowatts per year, of which only a small part has been utilized. And yet the country has about 2,400 electric power stations, of which the government owns the largest. At the present moment a single transmission line, that from Trollhattan on the west coast to Vesteras, sends enough electricity to the central Swedish industries to save 500 tons of coal a day. Soft coal costs $12.80 a ton. The check on coal consumption in the government institutions was begun in 1921 and by better firing methods and the use of more suitable grades of fuel, the savings averaged 15.5 per cent. for three years, representing a net reduction in outlay of over $536,000.

THE first sample of synthetic gold which has reached this country is to be an exhibit in the collection of elements at the American Museum of Natural History in New York. Dr. George F. Kunz, the well-known gem expert, who has the difficult task of gathering together samples of as many of the ninety-two elements as can be obtained or exhibited, states that the sample of what is said to be synthetic gold is a tiny speck. It is a product from the laboratory of Professor Hantaro Nagaoka, of the Tokyo Imperial University, who obtained microscopic quantities of what he reports to be artificial gold from mercury by running a mercury lamp over a long period and employing extremely high voltage. Dr. Kunz has in his collection the first crystals of pure fluoride of hafnium and metallic hafnium. He has not yet obtained samples of the twe new elements, rhenium and masurium.

"THE Ancient Mariner never would have thirsted for water if that old sailor could have taken a film of water about .00000004 centimeters thick from the surface of the ocean," according to Professor W. D. Harkins, chemist of the University of Chicago. Any solution of salt water, he explains, has a thin film of pure water surrounding it. The volume of the solution may vary from a drop to an ocean, but the film is always present. The amount of salt dissolved in a given amount of water determines the thickness of the film. A dilute solution of table salt has a film of pure water about .00000004 centimeters thick around it; a concentrated solution has a film .000000024 centimeters thick. The film becomes thinner as the amount of salt increases. The thickness of the water film in the concentrated solutions is almost identical with the thickness of a salt molecule, .000000035. "All physical matter, from a shark's tooth to a dust particle, has a film surrounding it which is different in composition from the main mass of the substance. Our work is still in an early stage, and as progress is made it will prove to be of value to our great industries, such as soap making, leather tanning, dairying and meat packing, in which the chemistry of colloids plays an important part."

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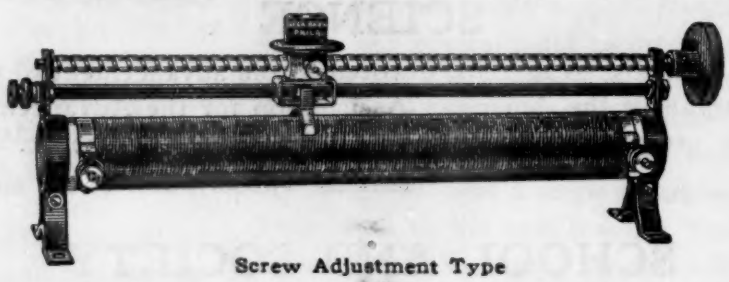

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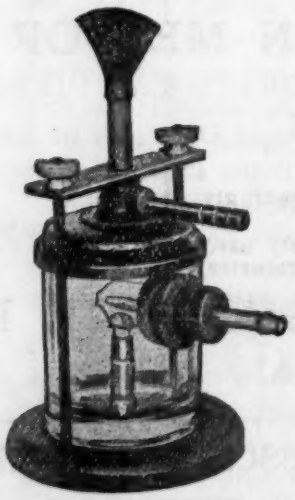

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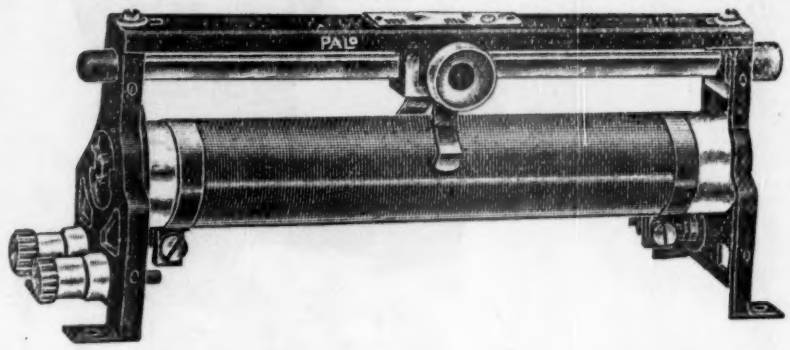

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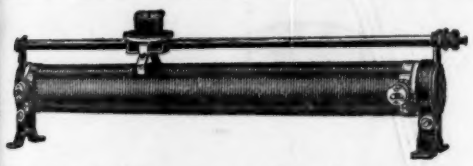

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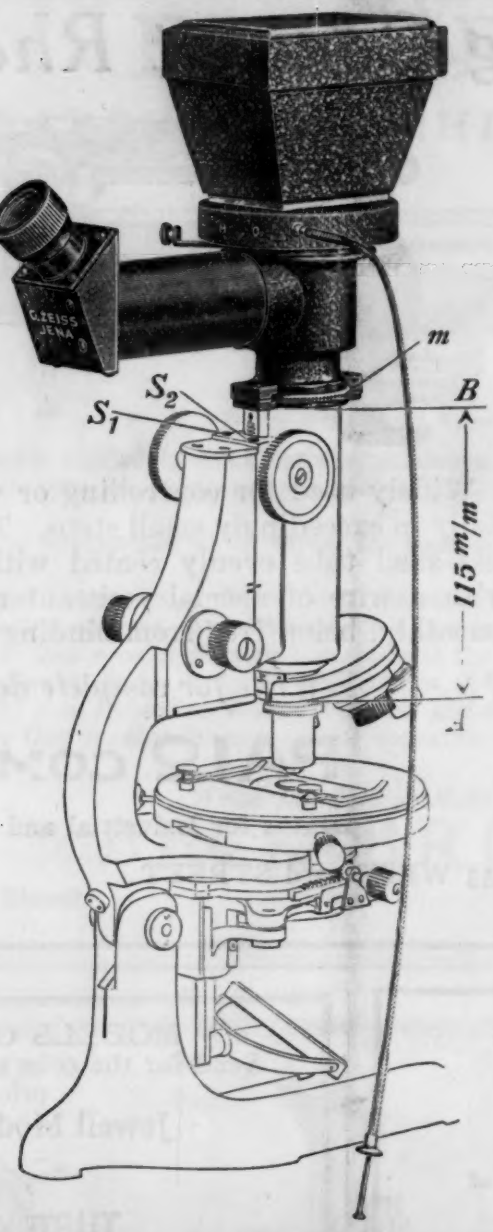

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